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ABSTRACT

The goal of the Developmental Approaches in Science, Health and Technology (DASH) program is to preserve the curiosity and capture the imagination of all elementary students through an experience of science, technology, and health that engages them in the excitement of exploring and understanding the unknown, inventing and building to solve problems, becoming better able to care for themselves, and gaining basic meaningful knowledge that will enable further school study. This document contains a teacher's guide for 2nd grade level. The document is divided into sections based on content. Activities include: (1) Learning; (2) Time, Weather and Sky; (3) Animals; (4) Plants; (5) Food and Nutrition; (6) Health and Safety; (7) Wayfinding and Transportation; (8) Energy and Communication, Conservation, Recycling, and Decomposition; (10) Matter, Space and Construction; (11) Start-up Activities; (12) Activity Plans; (13) Scope and Sequence; (14) Material List; and (15) Complimentary Materials. Each lesson plan includes objectives, background, student role, required materials, product, and procedure information. (Author/YDS)

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Grade 2
Teacher Guide

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Developmental Approaches in Science, Health and Technology

SE 067 329

Curriculum Research & Development Group
University of Hawai'i

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DEVELOPMENTAL APPROACHES IN SCIENCE, HEALTH AND TECHNOLOGY (*DASH*) PROGRAM
GRADE 2 TEACHER GUIDE

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DASH

GRADE 2
CLUSTER 1

Learning

2.1.1 The Learning Calendar
2.1.2 Last Year
2.1.3 Aphorisms
2.1.4 Helping Myself and Others
2.1.5 Getting Help
2.1.6 Making and Keeping Friends
2.1.7 Turns
2.1.8 School, Teacher, Friends, and Family
2.1.9 Predictions About Tomorrow
2.1.10 Planning for Tomorrow
2.1.11 Thinking
2.1.12 Library
2.1.13 Concept and Skill Inventory

GRADE 2
ACTIVITY GOALS

CLUSTER 1
Learning

2.1.1 The Learning Calendar
To continue development of the idea of the connected nature of learning by making a daily record of work done and by collecting data for long-term experiments and longitudinal multi-year studies; and to develop observation and recording skills.

2.1.2 Last Year
To validate the value and building nature of knowledge through retrieval and review of longitudinal data kept from DASH 1 in Science Record Books, Working Dictionaries, Connection Books, and Wonder and Discover Books.

2.1.3 Aphorisms
To compose and review a set of aphorisms that carry the import of selected conventional social, health, and safety behaviors essential to the lives of the students.

2.1.4 Helping Myself and Others
To develop a commitment to self-sufficiency through learning and a sense of responsibility for others and to develop interpersonal skills.

2.1.5 Getting Help
To identify the changing needs of humans for help from others during their lifetime; to identify ways to get help; to identify situations when help should be given; and to develop interpersonal skills.

2.1.6 Making and Keeping Friends
To continue development of the concept of friendship; to identify barriers to making friends; to identify effective ways of making friends; and to develop interpersonal skills.

2.1.7 Turns
To identify and address problems associated with taking turns and sharing and to develop interpersonal skills.

2.1.8 School, Teacher, Friends, and Family

To explore the organization of the school; to identify the roles of persons in the school; to know adults as persons; to expand the definition of family; and to develop interviewing, recording and reasoning skills.

2.1.9 Predictions About Tomorrow

To develop prediction and reasoning skills.

2.1.10 Planning for Tomorrow

To explore cause and effect in planing and to develop reasoning skills.

2.1.11 Thinking

To develop problem solving and reasoning skills.

2.1.12 Library

To reinforce the value and building nature of knowledge and to emphasize the importance of keeping longitudinal data in personal and class records.

2.1.13 Concept and Skill Inventory

To communicate to the teacher ones own perception of ones learning; to operationally define teaching; and to develop self assessment skills.

2.1.1 THE LEARNING CALENDAR

OBJECTIVES

The students
- Record data needed in long-term studies in meteorology and astronomy.
- Record events of environmental, technological, and scientific importance.
- Record events that are of importance to the class.

BACKGROUND

The DASH Learning Calendar is used at each DASH level. It is designed to be a class science and technology log. In it are recorded long-term data for meteorology and astronomy studies, things learned and events important to the class, unusual aperiodic events in the natural environment, and articles on the happenings in science and technology

Responsibility Chart

A companion device to the calendar is the Class Responsibility Chart. A responsibility chart is a list of jobs and persons responsible for doing those jobs. A chart should be created at the same time the calendar is introduced. It is important that the chart be constructed to allow new jobs to be added and job assignments to change. The form of the chart can be a class invention. Monitoring of the completion of jobs should be joint endeavor of the teacher and students.

Long-Term Data Collection

DASH assumes that the students learn through the experience of personally interpreting the world around them. Many phenomena can be interpreted effectively only after extensive data have been collected. This is particularly the case where meteorological and astronomical phenomena are involved. In DASH data concerning the weather and astronomy are collected over several school years, and each year they are subject to growing interpretations.

The Changing Nature of the DASH Learning Calendar

In DASH kindergarten through DASH 2, the calendar record is usually highly pictorial. Pictorial representation allows young students to more

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readily record and retrieve information. In DASH 2 or 3, depending on the development of the particular class of students, there is a transition time for the movement into more of a written recording mode.

Things Learned and Events Important to the Class

In DASH kindergarten through DASH 2 the calendar is heavily devoted to the recording of the things learned during the day. For all grades as part of the mental health (self-esteem and interpersonal bonding) component of DASH, records are kept of things important to individuals and the class a whole, such as birthdays, school events, and holidays.

Aperiodic Events and Articles

To extend student interest in the world of scientific and technological achievements and environmental events, encourage them to add current event articles or reports to the calendar.

Form of the Calendar

It is suggested that very heavy long-carriage computer paper be used to make the calendar. Such paper will produce a record that can be used and stored as a book and can be pulled out to make a continuous record. A 24-inch wide roll of butcher paper can also be used.

Storage of the Calendar

It is suggested that at the end of each school year the calendar be stored in the library so that data can be used in later years.

The Grade 2 Calendar

Suggested calendar entries for DASH 2 are shown in the following table. Where similar data have been collected in previous levels of DASH, these levels are identified under the column headed Experience. Suggested times for starting records are also shown.

KEY

AN	As needed	F	Fall
B	Beginning of the year	W	November
C	Continuing	S	Spring
I	Introduced		

CALENDAR TABLE

Calendar Entries	**When to Start**		**Experience Grade K**	**1**	**2**
Date					
Day, month, year	B		I	C	C
Day of the week	B		I	C	C
Season	B		I	C	C
Weather					
Temperature	B	(See Activity 2.2.1)	I	C	C
Weather logos	B	(See Activity 2.1.1)	I	C	C
Wind direction	F	(See Activity 2.2.2)		I	C
Wind speed	F	(See Activity 2.2.2)		I	C
Rainfall	F	(See Activity 2.2.5)			I
Snowfall	AN	(See Activity 2.2.6)			I
Astronomy					
Moon phase	B	(See Activity 2.2.4)	I	C	C
Sunrise, Sunset	B	(See Activity 2.2.3)		I	C
Eclipses	AN	(See Activity 2.8.5)			I
Moonrise, Moonset	W	(See Activity 2.2.4)			I
Special Events					
Birthdays	AN		I	C	C
School events	AN		I	C	C
Holidays	AN		I	C	C

Beginning the Calendar

Data collection on observations should begin early in the school year and be recorded on the calendar. It is suggested that the responsibility for making entries on the calendar be divided up and that groups of two or more students be assigned to each entry on the calendar. Mechanically, this usually solves the problem of someone being absent on the day of the assignment and provides a way to introduce new students to these DASH activities. By dividing up the responsibility among several groups, more students are regularly involved and the class as a whole will have a greater sense of contribution and ownership.

Sources of Astronomical Data

Astronomical data can be gotten from observation, from many newspapers, from almanacs, and off the internet. It is suggested here that the students who have previous experience in dealing with the astronomical data begin to practice their predicting skills.

STUDENT ROLES

Astronomer
Meteorologist
Chronicler

MATERIALS

compass (steel nail, magnet, cork or Styrofoam, plastic water container for homemade compass)
stake for wind detection device
yarn or other material for wind detection device
chart paper for Responsibility Chart
felt pens
calendar paper
Student Page 2.1.1 WEATHER LOGOS

PRODUCTS

Responsibility Chart
The Learning Calendar
Completed Student Pages

PROCEDURES

1. **Introduce the calendar by pointing out that again the students will be collecting data each day for interpretation. List the information that is to be collected. Set up a Responsibility Chart adding jobs over time. See Calendar Table above.**

Include

Date
- Day, month, year
- Day of the week
- Season

Weather
- Weather clear, partially cloudy, cloudy, rainy, snowy. (Some areas may choose to add smoggy and other weather conditions.) See Student Page 2.1.1 WEATHER LOGOS.
- Temperature, Fahrenheit and Celsius inside
  ✔ See Activity 2.2.1 TEMPERATURE.
- Temperature, Fahrenheit and Celsius outside
  ✔ See Activity 2.2.1 TEMPERATURE.
- Wind
  ✔ See Activity 2.2.2 WIND.

Astronomy
- Sunrise, Sunset
  ✔ See Activity 2.2.3 SUNRISE, SUNSET, AND SEASONS.
- Moon phase
  ✔ See Activity 2.2.4 MOONRISE AND MOONSET.

Special Events
- Birthdays
- School events
- Holidays
- Health news
- Major local news

2. **Have the students invent weather logos. See Student Page 2.1.1 WEATHER LOGOS.**

3. **Help the students organize their calendar and lay out a plan so that there is an assigned space on the calendar panel for the items they are to record.**
   ✓ Periodically review the plan for adequacy.

4. **Have the students start data collection and recording.**

5. **Have the students periodically review the calendar to reflect on what they have learned.**

EXTENSION

- Have the students predict where on the calendar they will find their birthdays. Have them mark this location. This helps the students to start to think of long-term projections.

2.1.2 LAST YEAR

OBJECTIVES

The students
- Check out their Science Record Books from the library.
- Review what they did in DASH 1.
- Review questions that have not yet been answered.

BACKGROUND

In DASH it is important that there be continuity of conceptual development from DASH level to DASH level. As a device to help ensure this continuity, several records are designed to be kept and transmitted from one grade to the next. These include the items below.

• The Learning Calendar	(One copy kept in the library)
• The Working Dictionary	(One copy per next-level teacher)
• The Wonder and Discover Book	(One copy per next-level teacher)
• The Connections Book	(One copy per next-level teacher)
• Science Record Book	(Kept for each student)

The Learning Calendar

The Learning Calendar can be kept in its box or roll and made available to classes in subsequent years when they are studying seasonal and astronomical data. This will be especially important in DASH 4 and 6.

The Working Dictionary

The Working Dictionary is ideally photocopied at the end of each school year. A copy of the Working Dictionary is then passed on to each teacher at the next grade level receiving DASH students who created the dictionary the year before. Ideally, the DASH 2 teacher will receive several Working Dictionaries, broadening the richness of ideas to be combined as definitions continue to evolve.

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The Wonder and Discover Book

The Wonder and Discover Book ideally is also photocopied at the end of the year so that copies can be passed on to each DASH 2 teacher. This record of ideas yet to be explored gives the students a sense of mission and continuity as they start the new year.

The Connections Book

The Connections Book too is ideally photocopied and passed on to each DASH 2 teacher. This record of connections already made reminds students of the utility of their learning.

The Science Record Book

The Science Record Book is the personal record of important information that needs to be transmitted from one year to the next for longitudinal studies. It usually includes the items below.

- Personal growth charts
- Personal dental records
- Concept and skill inventories
- Records of long-term projects such as decomposition projects, astronomical observation projects, and seasonal change projects.

When possible the Science Record Books, the Wonder and Discover Books, The Connections Books, and the Working Dictionaries are stored over the summer in the library and then checked out in the fall. If the Science Record Books have been stored in the library the students will probably have made a card for the card file. See Activity 2.1.12 LIBRARY for an activity similar to the one done in DASH 1. This retrieval is intended to give the students a sense of the importance of their personal work and to reinforce the idea that science is based on the long-term collection of data and information. To emphasize the importance of the work, the retrieval should be done with some pomp and ceremony. This could be the time for the librarian to discuss the importance of the library as a repository for works of knowledge.

After retrieval, the students should take time to review the documents.

STUDENT ROLES

Scientist
Chronicler

MATERIALS

Science Record Books
Wonder and Discover Books
Working Dictionaries
Connections Books
Student Page 2.1.2 WONDER AND DISCOVER

PRODUCTS

Completed Student Pages

PROCEDURES

1. **Discuss with the students the need to retrieve their Science Record Books, Connections Books, Wonder and Discover Books, and Working Dictionaries from last year.**

2. **If DASH books were stored in the library, work with the librarian to help the students retrieve records and to talk about the library as a place to store knowledge.**

3. **Have the students go through their Science Record Books.**

   Help them with such questions as
   - What did you do last year and what helps tell what you did?
     ✔ Work to the idea that the Concept and Skill Inventories help tell them what they did.

   - Judging from last year's growth information, how much do you think you will have grown this year?
     ✔ Record predictions.

   - What other information do you have in your SCIENCE RECORD BOOK that you need to keep in mind?

4. **Have the students review their work of the previous year. Go over the Wonder and Discover Books.**

   See whether anyone has
   - Answers to questions left unanswered in the spring.

- New questions that they would like to add after the summer. ✔ Where possible if these are questions of fact, suggest that the student who asked the question research the question. Record these personal questions on the SP 2.1.2 WONDER AND DISCOVER.

5. **Have the students review their work of the previous year. Go over the Connections Book and Working Dictionary.**

EXTENSION

- Have the students report on other codes used to identify books.

2.1.3 APHORISMS

OBJECTIVES

The students
- Invent aphorisms.
- Rate their understanding of selected aphorisms.
- Rate their practice of the aphorisms.

BACKGROUND

Throughout DASH the students are given a wide exposure to recommended health and safety practices. The list is large. Mnemonic tools are needed to ensure that attention is given to these practices.

One device that probably had its beginnings at the campfires of our first speaking ancestors is the aphorism or pithy statement that captures a truth. Aphorisms can become so associated with our daily activities as to be triggered spontaneously at an appropriate moment to remind us that some special action should be considered. Add aphorisms to songs, poetry, rhymes, and jingles to help carry some part of the message of appropriate health and safety practices, and we have a powerful set of remembering tools.

When to use

Create aphorisms when ever an appropriate health or safety situation arises. Introduce the rating part of this activity at the end of a semester. The students are asked to rate each of the aphorisms in terms of how well they understand it and how it affects their behavior. Use the rating twice in the year, preferably along with the inventory from Activity 2.1.4 HELPING MYSELF AND OTHERS at New Year's and at the end of the school year.

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STUDENT ROLE

Health consultant

MATERIALS

Student Page 2.1.3 APHORISMS

PRODUCTS

New aphorisms
Completed Student Pages

PROCEDURES

1. **Have the students invent new aphorisms whenever appropriate health, safety, or social situations arise.**
2. **Have the students rate their understanding and use of the ideas in the aphorisms on Student Page 2.1.3 APHORISMS.**
3. **Discuss with the class the meaning and continuing value of the aphorisms.**

Some Suggested Aphorisms

	CONCEPT	SOME APHORISM
1.	Eat adequate and appropriate food.	Eat the basic three, In wide variety.
2.	Go slow on sugar, fat, and salt.	Slow down sugar, Slow down fat, A dash of salt is Enough of that.
3.	Get 8 hours of sleep.	Sleep for eight, Wake up feeling great.

4.	Replace the water that you lose each day. Drink adequate amounts of liquids (6–8 glasses of water).	Six glasses in winter And eight in summer Are my body's natural plumber.
5.	Wash hands before eating. Wash hands before handling food. Wash hands after using the toilet.	Wash hands before eating or fixing a hurt, After using the toilet or working in dirt.
6.	Don't eat or drink using someone else's silverware, plate, or glass.	Someone else's dishes Are someone else's germs.
7.	Attend to tooth care. Both brush and floss.	Brush twenty times up and twenty times down, Inside and outside and all around. Floss in between To complete the routine.
8.	Attend to skin and hair care.	Healthy skin and hair Are clean skin and hair.
9.	Wear appropriate clothes for the weather and time of day.	Winter clothes feel comfortably warm. Summer clothes feel comfortably cool. Wear white at night.
10.	Make regular use of the toilet.	When nature calls, Listen and go. Wipe and flush, And wash, just so.

11.	Make your environment safe and clean.	A clean and safe space, Is a great workplace.
12.	Keep lips in the water and off the fountain.	Mouth in the water, Not on the fountain, Keeps those germs from Growing and a sproutin'.
13.	When sick stay away from others.	When sick stay home Don't let your germs roam.
14	Cover your nose and mouth when sneezing or coughing.	Don't sneeze or cough With the cover off.
15.	Share with those about you.	Sharing with others is Caring for others.
16.	Remember to carry out your responsibilities.	Get the job done, Then have fun.
17.	Plan ahead.	Plan when you can.
18.	Help those who need help.	Lend a hand when you can.
19.	Know the emergency phone number.	Remember 911 When emergencies come.
20.	Play a fair game.	Play fair with others And they'll play fair with you.
21.	Put things away when you're finished.	Finished for today? Then put your things away.
22.	Treat all living things with respect.	Other things live here too. They need respect from me and you.

EXTENSION

- Have the students make posters of their own aphorisms about things to be remembered. Post in appropriate places.

2.1.4 HELPING MYSELF AND OTHERS

OBJECTIVES

The students
- Rate progress in their demonstrated ability to be self-sufficient.
- Rate progress in their demonstrated ability to help others, including families and classmates.

BACKGROUND

This activity continues the theme of self-sufficiency and community contribution started in kindergarten. It is designed to give the students an opportunity to set goals and monitor achievement of personal goals. It should be introduced reasonably early in the year. Ideally, the students have a record of the personal goals they set for themselves at the end of first grade to be achieved over the summer. The goals are usually stored in their Science Record Books. These goals should be evaluated and additional goals should be set for grade 2. Monitoring of achievement of goals should occur at the end of the first semester or New Year's and at the end of the school year.

There are two parts to personal goal setting, consideration of
- Things I want to do for myself this year.
- Things I want to do for others this year.

The number of items listed by different students will vary widely. The number of items should not be of concern. What is important is that the students set goals that they can reasonably achieve. Additional goals can be added at any time.

Monitoring can be done along with Activity 2.1.3 APHORISMS. The students use Student Page 2.1.4 HELPING MYSELF AND OTHERS to rate themselves to see how they are progressing in achieving their personal goals.

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There are two parts to the rating scale, ability and practice.

Ability
When the opportunity is presented
1. I cannot yet do what my goal calls for.
2. I can do what is called for in my goal.
3. I can do and teach someone else what is called for in my goal.

Practice
When the opportunity is presented
1. I do not do what my goal calls for.
2. I sometimes do what my goal calls for.
3. I almost always do what my goal calls for.

STUDENT ROLES

Self-sufficient person
Community contributor

MATERIALS

Student Page 2.1.4 HELPING MYSELF AND OTHERS

PRODUCTS

New and revised personal goals
Completed Student Pages

PROCEDURES

1. **Have the students review their lists of personal goals they set at the end of DASH 1 and evaluate how well they met their goals.**

   Ask such questions as these:
   - Why do we want to do things for ourselves?
   - What disadvantages are there in having to rely on others to help us do things?

- What are some of the things that even adults need help with? ✔ Get at such things as health decisions—what to do when they get hurt, or sick—what to do when the family is going to do things together (family decisions).

- How do you feel when you learn to do something that you have not been able to do for yourself before?

2. Have the students discuss some of the things that they might achieve during the coming year to help themselves, families, and friends. Have them list these ideas on Student Page 2.1.4 HELPING MYSELF AND OTHERS.

3. Help the students make out their goals for the year which may include things from previous years that are not yet achieved.

4. At semester's end have the students monitor and reset goals. Review with the students the rating scale.

EXTENSION

- Have the students make a list of class goals.

2.1.5 GETTING HELP

OBJECTIVES

The students
- Identify times when help is necessary to satisfy our basic biological needs.
- Identify times when animals need help to satisfy basic biological needs.
- Discuss how we get help.
- Discuss when to give help.
- Discuss attitudes toward help.

BACKGROUND

GETTING HELP is part of the DASH mental health sequence. Giving and receiving help is fundamental to our human survival. In this activity the students explore the levels of helplessness that characterize our species and contrast our relative reliance on help with that of other animals.

The activity develops the idea that our society is one built around helping and that work generally and education in particular have the helping of others as a basic goal. Finally, the students are asked to consider their attitude toward helping at school. They are encouraged to learn skills and ways of doing things so that they can care for themselves and others. Toward others they are asked to aspire to a level of knowing that allows them to teach. Therefore, their attitude toward helping others when appropriate should evolve into one of a teacher and a co-learner.

STUDENT ROLES

Philosopher
Teacher

MATERIALS

Student Page 2.1.5A HELP
Student Page 2.1.5B GETTING HELP

PRODUCTS

Concept map about help
Completed Student Pages

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PROCEDURES

1. **Have the students work in small groups to develop a concept map about help. From group work create a class concept map.**

   Ask such questions as these:
   - What do you need help for?
   - When do you need help?
   - How do you get help?
   - When do you give help?
   - How do you feel about helping others?
   - How do you feel about asking for help from others?

2. **Help the students work with the Student Page 2.1.5A HELP to find out at what time in their lives they can do the things necessary to satisfy their basic biological needs.**

   Ask such questions as these:
   - What kinds of things can babies do?
     ✔ Get at breathing, eating, eliminating, etc. Identify these as satisfying their most basic biological needs.
   - Are there biological needs that humans must learn how to satisfy?
     ✔ Get at finding and making shelters (houses), finding food (hunting, gathering, growing),protecting oneself from illness, and so forth.
   - What kinds of things take humans the longest to be able to do? Why might this be so?
     ✔ Get at being a good athlete, doing the things schools prepares us for (being a mechanic, a carpenter, a doctor, a school teacher).
     ✔ Get at the need to train our bodies for a long time to be good athletes and the need to learn about all the things required in many jobs.

3. **Have the students contrast the ability of other animals to do the same things that humans have to learn to do. Help them complete Student Page 2.1.5A HELP.**

   Ask such questions as these:
   - What kinds of wild animals can take care of all of their biological needs themselves when they first come into the world?
     ✔ Get at fish, turtles, insects, and so forth.

- What kinds of wild animals are dependent on parents for some time?
  ✔ Birds and mammals.

- What kinds of wild animals take the longest to time to be able to live on their own?
  ✔ Birds and hunting mammals.

- How does the period of dependency of these animals compare with our human period of dependency? Which is longer? Why might this be so?

- What must we do to get water?
  ✔ Get at the idea that we must learn to use technology (turn on a faucet, go to the refrigerator, even drinking from a stream takes practice and may require tools).

- What must we do to get food?
  ✔ Get at the idea that we must learn to use technology (going to a grocery story, growing a garden, even gathering from the wild may require tools).

- What must we do to get body protection?
  ✔ Get at the idea that we must learn to use technology (sew clothes, buy shoes).

- What must we do to get predator protection?
  ✔ Get at the idea that we must learn to use technology (drive cars to travel through Africa, use fences to keep wild animals away).

- What must we do to communicate with others?
  ✔ Get at the idea that we must learn a language (to speak, read).

4. **Explore the question "When do you need help?"**

Help the students to get at such ideas as

- When you can't do something yourself that you need to have done.

- Subdividing *can't do* into *never can do* and *can't do now.*
  ✔ Things we *never can do* include situations such as doing a brain operation on yourself or eating lunch in San Francisco at the same time you are surfing in Honolulu.

- When it is quicker or easier for someone else or for more than one person to do something.

5. **Explore the question "How do you get help?"**

Get at such things as

- Asking for help from teachers, parents, and others.

- Buying help.
  ✔ This is an opportunity to discuss that most of the jobs people work at produce things or provide services that help us. Our society is built around the idea of sharing in the work that has to be done. In our work we are helping each other by doing things that others don't have time or know how to do. Work at and discuss Student Page 2.1.5B GETTING HELP.

- Helping yourself by learning to do things.
  ✔ Get at the idea that this is the reason for education in school and teaching at home. What society is attempting to do is help the students become independent so they can help themselves and others, now and throughout life. Work at and discuss Student Page 2.1.5B GETTING HELP.

6. **Explore the question "When do you give help?"**

Help the students work toward the following kinds of ideas

- When there is a group or community project and their services are needed.

- When they can do something that someone else needs to have done and can't do.

- When someone asks them to do something that is good and proper and will really help them.

7. **Explore the question "How do you feel about helping at school?"**

Work toward the following kinds of ideas

- Desire to learn skills, ideas, ways to get things done so they do not need to have help. The idea of personal empowerment.

- Desire to reach a level in their learning so they can teach others to help themselves.
  ✔ Helping should be directed at getting others so that they do not need help.

EXTENSION

- Have the students try to name jobs that do not have a helping character to them.

2.1.6 MAKING AND KEEPING FRIENDS

OBJECTIVES

The students
- Identify problems in ways of making friends.
- Demonstrate positive ways of making friends.
- Develop positive ways to approach making lasting friendships.

BACKGROUND

This activity continues to develop the theme of making friends started in kindergarten. Second grade students are generally ready to begin to analyze the kinds of things that make friendships lasting. To remove the teacher from the stage in the beginning activity it is suggested that puppets be used as protagonists of the positions taken. Puppets are also suggested as a vehicle for the students' own creation of friend-making situations.

STUDENT ROLE

Puppeteer

MATERIALS

socks or paper bags for puppets
chart paper
markers
Student Page 2.1.6 MAKING FRIENDS

PRODUCTS

Puppets
Class chart about making friends
Completed Student Pages

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PROCEDURES

1. **Have the students make simple puppets out of paper bags, socks, or other supplies**

2. **Introduce some problems in making friends by reading a series of short statements that are typical of the way some people think. This can be done using a puppet as a protagonist.**

3. **Statement 1.—Said to self. "I want to be your friend but I'm afraid you'll say that you don't want to be my friend, so I won't tell you how I feel unless you tell me first."**

   Ask such questions as these:
   - Why might this person be afraid to be your friend?
   - What must you do to be a friend to this person?
   - Is it easy to make friends with a person like this? Why?
   - Why might a person feel or think this way?
   - Have you ever known anyone who thinks this way? How did they make friends?
   - How could you help someone who thinks this way?

4. **Statement 2.—Said to you, "I'll be your friend if you do what I want you to do."**

   Ask such questions as these:
   - What must you do to be a friend with this person?
   - Is it easy to make friends with a person like this? Why?
   - Why might a person think or feel this way?
   - Have you ever known anyone who thinks or feels this way? What kind of friendships did they have?
   - What would you say to someone who thinks this way?

5. **Statement 3.—Said to you. "I'll be your friend until you do something that I don't like."**

   Ask such questions as these:
   - What must you do to be a friend with this person?
   - Is it easy to make friends with a person like this? Why?
   - Why might a person think or act this way?
   - Have you ever known anyone who thinks or acts this way? What kind of friendships did they have?
   - What would you say to someone who thinks or acts this way?

6. **Statement 4.—Said to you. "You have to do something nice for me before I'll be your friend."**

   Ask such questions as these:
   - What must you do to be a friend with this person?
   - Is it easy to make friends with a person like this? Why?
   - Why might a person think or act this way?
   - Have you ever known anyone who thinks or acts this way? What kind of friendships did they have?
   - What would you say to someone who has a friend who thinks or acts this way?

7. **Statement 5.—Said to you. "I'll be a friend until my friend Jane comes back."**

   Ask such questions as these:
   - Why is this person willing to be your friend?
   - What will happen to your friendship after Jane gets back? Why?
   - Is it easy to make friends with a person like this? Why?
   - Why might a person think or act this way?
   - Have you ever known anyone who thinks or acts this way? What kind of friendships did they have?
   - How could you help someone who thinks or acts this way?

8. **Statement 6.—Said to you. "I can only be your friend if my friend Bill likes you too."**

Ask such questions as these:
- What must happen for you to be a friend of this person?
- Is it easy to make friends with a person like this? Why?
- Why might a person think or act this way?
- Have you ever known anyone who thinks or acts this way? What kind of friendships did they have?
- What would you say to someone who has a friend who thinks or acts this way?

9. **Have the students work in small groups to list positive ways of thinking about how to make friends.**

Help them include such things as
- By helping others.
- By receiving help.
- By being kind to others.
- By receiving kindness from others.
- By being forgiving.
- By accepting people as they are.
- By looking for and seeing good things in other people.
- By having good qualities that can be seen in you.

10. **Have student groups create puppet plays to illustrate positive ways of thinking about and making friends.**

11. **Have the students discuss each performance.**

Ask such questions as these:
- What is the important thing shown here about making friends?
- Is the thing illustrated important to lasting friendship? Why?

12. Have the students list positive ways of thinking about and making friends using Student Page 2.1.6 MAKING FRIENDS. Have them share their ideas and compile them on a class chart about making friends."

EXTENSIONS

Have the students create aphorisms about making friends such as

- True friendship is never easy.
- A friend is one who knows all about you and likes you just the same.
- A real friend walks in when the rest of the world walks out.
- To make a friend, be a friend.

2.1.7 TURNS

OBJECTIVES

The students
- Role-play situations involving sharing and turn taking.
- Invent class procedures for taking turns.
- Invent class procedures for sharing resources.

BACKGROUND

Taking turns and sharing are two of the more difficult acts of social interaction for students. Therefore, there must be agreed-upon procedures or protocols for both sharing and turn taking if the micro-society of the school and classroom are to function in a civilized manner. Behind both sharing and turn taking is the idea of fairness based on the equality or rights of persons. This is a very potent idea essential to our democratic system and thus worthy of attention.

Fairness as an idea is already in the experience of most children by second grade, and that experience can be drawn upon to help establish class procedures for sharing and turn taking. To get into the problem a series of situations are suggested for role-playing. Role-playing is more easily done using puppets with young students.

Problems connected with personal property and sharing will have different solutions according to the attitudes of the individuals, the class, and the situation.

This activity is one that should be done ONLY when there is a call for establishing sharing and turn-taking procedures. If the students already function with fairness and kindness it may not be necessary to introduce the activity.

STUDENT ROLES

Puppeteer
Philosopher

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MATERIALS

chart paper
socks for puppets
paper bags for puppets
markers
Student Page 2.1.7 TAKING TURNS

PRODUCTS

Concept map about fairness
List of class rules and procedures
Puppets
Completed Student Pages

PROCEDURES

1. **Introduce the activity by noting that situations have come to your attention in which people have not fairly shared resources and/or have not fairly taken turns. Have the students make a concept map about fairness in sharing and taking turns**

   Help them to include such ideas as

   - Having the same amount of time.
   - Having the same access to scarce things.
   - Applying rules to all people equally.

2. **Suggest that one way of deciding what is fair is to look at situations in which people complain of unfairness. To understand these situations we need some actors.**

   - Provide puppets or help the students make simple bag or sock puppets.
   - Arrange the classroom for an interactive situation.
   - Have the students act out the stories.
   - Discuss each situation after it has been presented. See Procedure 8 and 9.

4. **Situation 1: Sharing a limited common resource.**

Connie and Harold came to school early to finish up their poster. Only one bottle of yellow paint is left on the shelf, and they need lots of yellow paint for the sunlight. A little later Bishop and Mary come in to finish their poster. They need yellow paint too. Bishop asks to use some of the yellow paint. Connie says *NO* because they need all of the paint and besides she and Harold got it first. Just then Isabella, another student, comes into the room and Bishop complains, "They're not being fair. They won't share the yellow paint."

Have the students role-play Connie's and Harold's position and Mary's and Bishop's position with Isabella acting as a mediator.

5. **Situation 2: Sharing a personal resource.**

Henry has a colored-pencil set his uncle gave him for Christmas. His friend Denise asks to borrow the red pencil when she can't find her own. Bill, who is new to class and in another group, asks to borrow Henry's orange pencil. Jay, who never returns anything, asks to borrow his yellow pencil. Mrs. Steward, the teacher, asks to borrow his green pencil.

Have the students role-play Henry and the borrowers.

6. **Situation 3: Rules and taking turns.**

Erica and Robert are captains of two ball teams that play at recess. Today's game is the third game that the two teams have played, and the winner will be the Recess Champion Team. The bases are loaded, and it's Julian's turn at bat. Julian has hit the ball only twice all year, and both times he was put out. Erica didn't want Julian in the first place, but he was the only one left when they chose teams so she had to take him. Just as Julian is going to the plate Erica says, "I'm changing the batting order. I'll hit in Julian's place." Robert comes running up to Erica shouting, "You can't do that! It's Julian's turn."

Role-play Erica's and Robert's position with Phyllis as an umpire.

7. **Situation 4: Turns and first come first served.**

   Fernando, Mel, and Burt have been making roads in the sandbox all morning. Wendy, Alice, and Michi want to build a sand city. But Burt says, "We were here first, so you girls can have your turn if you get here first tomorrow."

   Role-play the two positions with Mr. Sherman, the playground supervisor, stepping in if the argument cannot be decided.

8. **Have the students analyze each situation after it is role-played, reporting the things favoring each position or side.**

   Ask such questions as these:
   - What was the argument about?
   - What did each side have to say?
   - What are some possible solutions to the argument?
   - Which solutions seem fairest? Why?
   - What other kinds of situations can you think of that are like the one we have just seen?

9. **Have the class generalize about the situations and establish turn taking and sharing procedures. Record their ideas on chart paper and post this class list of sharing and turn-taking procedures.**

   Ask such questions as these:
   - What procedures should we follow when we have turn-taking situations like these come up again later?
   - What procedures should we follow when we have sharing situations like these come up another time?
   - Are there other situations involving fairness for which we need procedures?
   - What procedures should we follow when we have situations like these happen?

EXTENSIONS

- Have the students make up their own role-playing scenarios about sharing, taking turns, and other fairness situations and have students act them out. Help them notice how they are solved and what, if any, additional procedures are needed. Add to their class list of sharing and turn-taking procedures.
- Have the students keep track of actual arguments involving sharing, turn-taking, and other fairness situations. Help them notice how they are solved and what, if any, additional procedures are needed. Add to their class list of sharing and turn-taking procedures.

2.1.8 SCHOOL, TEACHERS, FRIENDS, AND FAMILY

OBJECTIVES

The students

- Interview school staff members and write biographies.
- Interview classmates and write biographies.
- Develop a school organizational chart.
- Identify the people in the school as a kind of family, with rights and responsibilities.
- Create a concept map and working definition of family.

BACKGROUND

This activity is part of the mental health series. It is designed to give the students a sense of belonging to the social institution called school. The students interview teachers and staff to discover each member's function and things about their personal background. This helps to humanize the operation of the school so that it can be seen as people doing things for people.

The model of the family is used to describe the school. *Family* is used here in the sense of a group of persons with a common affiliation. The model of the helpful, caring, working-together family unit can be used as the goal for classroom organization.

STUDENT ROLE

Biographer

MATERIALS

Working Dictionary
markers
chart paper
Student Page 2.1.8 SCHOOL FAMILY INTERVIEW

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PRODUCTS

Biographies
Bulletin board displays of school staff and class members
Concept map about family
Working definition of family
Completed Student Pages

PROCEDURES

1. **Announce that during the next several days the class will have a people hunt. Give small groups of students the names of different members of the staff and have them find out what they do in the school and a bit of biography. Help the students draw up a set of questions to ask each staff member. Have them record these on Student Page 2.1.8 SCHOOL FAMILY INTERVIEW.**

   Include such questions as these:
   - What it the job they do in the school?
   - Where do they work in the school.
     ✔ Room 23A, cafeteria, office, etc.
   - How long they have been working at the school?
   - Where did they go to school?
   - Do they have children and/or grandchildren?
   - What do they like to do when they are not working?

2. **Help the students write a biography of each staff member using the responses to the questions. Use Student Page 2.1.8 SCHOOL FAMILY INTERVIEW.**

3. **Help the students make an organizational bulletin board display of all the staff personnel using the biographies.**

   Help them
   - Group people with common functions.
     ✔ Teachers, office staff, custodians, etc.
     ✔ Photographs or drawing of staff members doing their jobs add realism to the display.

- Show leadership roles.
  ✔ Principals, food service managers, head custodian, and others.

4. **Help groups of students list the way staff and students can help each other. Add this to the display.**

   Have the list include such things as
   - Things that the people on the staff do for students.
   - Things that the students do or can do for the staff.

5. **Help the students make a second bulletin board or chart display of people in the classroom. Give the name of another student in the room to each student. Help the students draw up a set of questions to write a biographical sketch. Again, photographs will enhance the display.**

   Help them ask and use answers to such questions as

   - What is your full name?
   - How long have you been at the school?
   - Where do you live?
   - Do you have brothers and sisters? If so, what are their names and ages?
   - Do you have any pets? If so, what pets?
   - What is your favorite sport or thing to do?

6. **Have the students make a concept map about family.**

   Help them include such ideas as

   - Families are people who are closely associated.
   - Different families have different members.
   - Family members usually help each other.
   - Family members usually care about and look out for each other.

- Family members usually work together.

7. **Help the students analyze the concept of family and identify the school and its staff as a kind of family. Add new ideas to the concept map as they arise.**

   Ask such questions as these:
   - What are the things that a family does for its members?
   - How should one treat members of a family?
   - How is our school like a family?
   - What are some other groups that are like families?

8. **Have the students use their concept map to create a working definition of family. Record it in the Working Dictionary.**

EXTENSION

- Have the students write aphorisms about family relationships.

2.1.9 PREDICTIONS ABOUT TOMORROW

OBJECTIVES

The students
- Make predictions about future events.
- Determine how well their predictions came true

BACKGROUND

This is the first of a pair of activities that deal with predicting and controlling future events. The second in the series is Activity 2.1.10 PLANNING FOR TOMORROW. To get a sense of the predictability of events in their lives, the students make secret predictions about the next school day. Barring very unusual events, they should be able to make reasonably accurate predictions. If an unexpected event does occur, it can be noted and new predictions can be made again a few days later.

STUDENT ROLE

Futurist

MATERIALS

Working Dictionary
envelopes
Student Page 2.1.9 SECRET PREDICTIONS

PRODUCTS

Working definitions of prediction and future
Completed Student Pages

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PROCEDURES

1. **Help the students create concept map about prediction.**

   Ask such questions as these:
   - What do you mean when you say that you have made a prediction?
   - Do predictions always come true?
   - Why do you make predictions?
   - What do you say when you make a prediction?
     ✔ Get at the form of a prediction. "I predict that sometime in the future something will happen."
   - What groups of people are constantly making predictions?
     ✔ Start with people such as weather forecasters, agricultural forecasters, and almanac makers and move to the realization that everyone makes predictions, all of the time.

2. **Have the class play a prediction game.**

   Have small groups of students
   - Make 5 secret predictions about things that they think will happen at school tomorrow.
     ✔ Record their predictions on Student Page 2.1.9 SECRET PREDICTIONS.
   - Put their predictions into envelope time capsules.
   - Agree that they will not tell the other groups what they have written as their predictions.

3. **Return to the game the next school day and open the time capsules.**

   Have each group
   - Read their predictions and decide which came true.
   - Count the number of predictions that were correct and not correct.

4. Have the class analyze the predictions.

Ask such questions as these:

- What kinds of things were easy to predict?
  ✔ Get at the kinds of things that usually happen each day, the things that have been previously scheduled, the things the students said they were going to do, etc.

- What kinds of things are more difficult to predict?
  ✔ Get at unusual things, accidents, sometimes the weather, how we will feel physically, things that other people will do, etc.

- How successful were you in your predictions?
  ✔ Look at the number of correct and incorrect predictions.

- Why can you make a lot of correct predictions about what will happen in the future?
  ✔ Work toward the idea that many things happen with regularity such as the sun rising and setting and the ringing of school bells. Some things we have control over and can make happen such as getting dressed and eating.

- Why was it important to keep your predictions secret?
  ✔ Get at the idea that if someone had known our prediction, they might have stopped the prediction from coming true.

- What do we mean by *future*?
  ✔ Develop a working definition of future and record it in the Working Dictionary.

- What have you learned about the meaning of prediction?
  ✔ Add to and revise the concept map about prediction.
  ✔ Develop a working definition of prediction and record it in the Working Dictionary.

EXTENSIONS

- Periodically play the prediction game, helping the students become more accurate in their predictions.

- Add predictions to the Planning Calendar. See Activity 2.1.10 PLANNING FOR TOMORROW.

2.1.10 PLANNING FOR TOMORROW

OBJECTIVES

The students
- Set up a calendar for planning the school year.
- Discuss the effect of past action on present events.
- Plan an activity and identify the effects of past action on outcomes.

BACKGROUND

This activity continues the development of the concept of cause and effect. Here the emphasis is on how the students can control some of the events of the future by taking actions beforehand. Anticipating and preparing for the future are of major importance to good mental health. Planning is essential for scientific and technological work. The students need to understand that actions of the *here and now* have effects on their future.

Introducing the Planning Calendar early in the school year allows the students to practice their predicting and planning skills. This activity is designed to precede major long-term projects such as Activities 2.4.9 VEGETABLE GARDEN IN A BUCKET, 2.7.5 BUILDING A VILLAGE, or any other large scale class project. The important part of this activity is the discussion.

The Planning Calendar is usually a large calendar with all the months of the year on one page. This allows the setting out of major school events, birthdays, and other important happenings in one place for all to see.

STUDENT ROLES

Planner
Philosopher

MATERIALS

commercial one-page calendar or materials to make one
Student Page 2.1.10 PLANNING

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PRODUCTS

Class Planning Calendar
Completed Student Pages

PROCEDURES

1. **Early in the school year help the students set up a class Planning Calendar. Record scheduled school and class events, vacations, holidays, birthdays, and so forth. Make additions as appropriate.**

2. **At the end of a day have the students leave two or three books or other objects on top of their desks. When they come in the next day, allow them to do what they chose with the books. If they ask you what should be done, tell them that it is up to them to decide. After class has begun, discuss how putting the books out yesterday afternoon affected what they did today.**

   Ask such questions as these:
   - What did you do with your books that you left out last night?
   - Why did you do what you did with your books?
   - Did anybody not think about their books and just leave them on their desk?
   - How did what you did yesterday with your books affect what you did today?

3. **Have the students work in small groups to list three other things that the class did yesterday that affected what they have done or will do today. Discuss how things you have done in the past affect what they do now.**

   Ask such questions as these:
   - What things did you find affected today?
   - Did any group have a difficult time in finding three things that you did yesterday that will affect what you do today? Why?
   - What is meant by the aphorism *I make my tomorrows today*?
   - Why do you plan for things that you will do in the future?

- How does your planning affect the event you plan for?

4. **Have the students carry out planning for a long-term activity. Student Page 2.1.10 PLANNING may be used. Record major steps on the class Planning Calendar.**

5. **After the long-term activity is completed, have the class discuss how planning affected what was done.**

   Ask such questions as these:
   - How did your planning affect what you did in the activity?
   - What might have happened if you did not plan for the activity and just did it?
   - How can you make tomorrow better today?

EXTENSION

- Repeat the discussion of the effect of planning after other long-term activities.

2.1.11 THINKING

OBJECTIVES

The students
- Answer a questionnaire about the way they think when they solve a problem.
- Identify other ways they might have thought about that same problem.

BACKGROUND

This activity is designed to help students think about the way they solve problems. It should be introduced soon after the students have completed an invention activity. The students complete a questionnaire that focuses on the problem-solving process.

At this point in their development many students have not yet acquired the regular habit of thinking about a problem before they start to solve it. Asking questions about whether the students manipulate pictures and words in their minds as they invent draws attention to these kinds of mental processes. A visual imagery exercise is used to point up the power of these processes.

This activity can be used after any invention activity and several times if the ideas need reinforcement.

STUDENT ROLE

Psychologist

MATERIALS

Student Page 2.1.11 INVENTOR'S QUESTIONNAIRE

PRODUCTS

Completed Student Pages

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PROCEDURES

1. **Introduce the question "How did you think about your invention?" Help the students complete Student Page 2.1.11 INVENTOR'S QUESTIONNAIRE. To get at questions the students may have, the questionnaire may be read to them.**

2. **Have the students work in small groups to reflect on and then discuss their answers to the following questions.**

   - Did your members work about the same way when you were inventing?
   - How were the ways you worked similar? How were they different?
   - Did you do things that are not listed in the questionnaire? If so what were they?
   - Are there ways your group worked that could help others the next time you have an invention project?

3. **Have the students focus on their own thinking using mental pictures and words. Have them close their eyes and take them through a mental invention trip.**

   - Picture in your head going home this afternoon and opening the door that lets you into your home.
   - Look in front of you. What do you see? Look to the right. What do you see? Look to the left. What do you see? Keep looking at this picture in your mind.
   - Now look at the floor. You see a puddle of water that is getting bigger and bigger. Where do you think the water could be coming from?
   - The pool continues to get bigger and it's getting things wet. Picture in your mind what can happen to your home. What are you going to do?

4. **Have the students invent some scenarios in response to Procedure 3. Then discuss how they invented their stories.**

   Ask such questions as these:
   - Where did you think the water was coming from and what did you think you would do?
   - How many of you saw some kind of picture of your home, the water, and what you did to solve the problem of the water?
   - How many of you were talking to yourself as you were thinking about the problem?
   - Did anyone do something else as you thought about the situation? What did you do?
   - How was the way you worked with this thought problem similar or different from the way you did your invention?

5. **Provide the students with time before starting an activity to think about what is to be done and how they are going to approach the activity.**

6. **Give the students regular opportunities to walk through problem-solving situations emphasizing the visual and language components of mental operations.**

EXTENSIONS

Have the students
- Invent mind problems and share solutions.
- Read about famous inventors and how they worked to develop their inventions.
- Make a bulletin board about famous inventors.

2.1.12 LIBRARY

OBJECTIVES

The students
- Store their Science Record Books in the library.
- Make out identification cards for the library card file.
- Identify their Science Record Books with a retrieval code.

BACKGROUND

In DASH continuity of conceptual development from grade level to grade level is a priority. To help ensure this continuity, certain records are designed to be kept and transmitted from one grade to another. These include the items below.

• The Learning Calendar	(One copy kept in the library)
• The Working Dictionary	(One copy per next-level teacher)
• The Wonder and Discover Book	(One copy per next-level teacher)
• Connections Book	One copy per next-level teacher)
• Science Record Book	(Kept for each student)

All these records can be stored over the summer in the library to be checked out in the fall. The Learning Calendar can also be stored in the library for use in later years, particularly in DASH 4 and 6.

The Working Dictionary
The Working Dictionary can be photocopied or computerized at the end of each school year. A copy can then be passed on to each teacher at the next grade level receiving DASH students.

The Wonder and Discover Book
The Wonder and Discover Book can also be photocopied or computerized and passed on like the Working Dictionary.

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The Connections Book
The Connections Book can likewise be photocopied or computerized and passed on like the Working Dictionary

The Science Record Book
The parts of the students' Science Record Books to be passed on from one year to the next should be separated from the rest of the students' work. Information to be passed on includes personal growth charts, personal dental records, concept and skill inventories, records of long-term projects such as decomposition projects, astronomical observation projects, and seasonal change projects.

STUDENT ROLE

Science librarian

MATERIALS

coding materials
Science Record Books
Wonder and Discover Book
Connections Book
Working Dictionary
Student Page 2.1.12 LIBRARY CARD

PRODUCTS

Completed Student Pages

PROCEDURES

1. **Discuss with the students the need to store their Science Record Books, the Wonder and Discover Book, the Connections Book, and the Working Dictionary for use next fall.**

   Discuss the need to
   - Code the books using the system that the library uses to identify books.
     ✔ Work out the code with the librarian ahead of time.
   - Make a card for the card file or computer entry so that they can find the books next fall.

2. **Help the students code their books and make out the library cards. Have them use Student Page 2.1.12 LIBRARY CARD, other cards, or system as preferred by the librarian.**
3. **Have the students present their Science Record Books and cards to the librarian.**
4. **Make copies of the Wonder and Discover Book, Connections Book, and the Working Dictionary to be stored in the library.**

EXTENSIONS

Have the students

- Practice organizing a shelf of their materials in the classroom and retrieving them using the library cards they have made.
- Code and organize the class reference library.

2.1.13 CONCEPT AND SKILL INVENTORY

OBJECTIVES

The students

- Discuss the meaning of teaching someone something.
- Rate their understanding of selected concepts.
- Rate their capacity to use selected skills.

BACKGROUND

This activity is a continuation of the assessment component begun in kindergarten and extending through DASH 6. It is designed to engage the students in becoming aware of what concepts they have some understanding of and what skills they have gained some mastery over. The instrument used is called a Concept and Skill Inventory.

Assessment of both concepts and skills uses three levels of discrimination shown below.

CONCEPTS	SKILLS
• I do not understand the concept.	• I cannot carry out the skill.
• I understand the concept.	• I can carry out the skill.
• I can teach some else the concept.	• I can teach someone else the skill.

Use

It is suggested that the student and the teacher use the inventory independently. After the teacher and students have completed their ratings, discrepancies can be resolved in private discussions with the students. At the level of *understanding* the students can be asked what they know about a concept. At the level of *teaching* they can be asked to teach the concept to the teacher. In DASH teaching is considered the highest level of achievement.

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In the case of skills, the students' ability to perform or carry out a given skill can be directly tested by giving them a task involving the skill. The students should be constantly striving to gain the capacity to teach someone else both concepts and skills.

In addition to being a device to identify what students have learned, the concept and skill inventory can be used as a report of accomplishments to the home and for other school records.

STUDENT ROLE

Evaluator

MATERIALS

Focus Book *There's A New Kid Coming*
Student Page 2.1.13 CONCEPT AND SKILL INVENTORY

PRODUCTS

Completed Concept and Skill Inventories

PROCEDURES

1. **Read the Focus Book *There's A New Kid Coming.* Discuss what it means to teach someone something**

2. **Discuss the purpose of the Concept and Skill Inventory with the students.**

   Include such things as the Inventory
   - Allows students to tell what they think they know.

   - Shows what yet needs to be mastered or understood.

3. **Go over examples of what is meant by each response level of the inventory. Read the concepts and skills where necessary and have the students circle their level of understanding and mastery.**

4. **Discuss with individuals any differences in teacher and student perception of mastery and understanding.**

SUGGESTED SCRIPT

CONCEPTS:

1. Do you know what a **calendar** is and how to use it? ...NO, I do not know what a calendar is; YES, I do know what a calendar is; or I can TEACH the meaning of calendar to a friend who does not know what a calendar is. Put a circle around your best answer.
2. Do you know what **weather** is? Continue as above until all the students understand the pattern.
3. Do you know what **rainfall** means?
4. Do you know what **wind** is?
5. Do you know what a **moonset** is?
6. Do you know what a **prediction** is?
7. Do you know what **time** is?
8. Do you know what a **family** is?
9. Do you know what a **friend** is?
10. Do you know what **helping** means?
11. Do you know what **biological needs** are?
12. Do you know about the **anatomy** of a **fish**?
13. Do you know what an **insect** is?
14. Do you know about **insect metamorphosis**?
15. Do you know what a **predator** is?
16. Do you know what **soil** is?
17. Do you know about **pumps**?
18. Do you know about **plant roots**?
19. Do you know what a **plant bulb** is?
20. Do you know what **activation** is?
21. Do you know what **protein** is?
22. Do you know what a **vitamin** is?
23. Do you know what **nutrients** are?
24. Do you know what **carbohydrate** is?
25. Do you know what **wellness** means?
26. Do you know what **microorganisms** are?
27. Do you know what **safety** means?
28. Do you know what **911** is for?
29. Do you know about **wheels**?
30. Do you know about **pulleys**?
31. Do you know what a **transportation system** is?
32. Do you know about **sunlight**?
33. Do you know about **shadows**?
34. Do you know about **temperature**?
35. Do you know about **seasons**?
36. Do you know what an **eclipse** is?

37. Do you know what it means to **recycle** something?
38. Do you know what **pollution** is?
39. Do you know what **conservation** is?
40. Do you know what **decomposition** means?
41. Do you know what it means to **preserve** something?
42. Do you know what an **organizer** does?
43. Do you know what **storage** means?
44. Do you know what **weighing** something means?
45. Do you know what a **gram** is?
46. Do you know what a **centimeter** is?
47. Do you know what it means to make a **survey**?
48. Do you know about **energy**?
49. Do you know what **science** is?
50. Do you know what **technology** is?

SKILLS:

1. Do you know how to **cooperate**? ...NO, I do not know how to cooperate, YES, I know how to cooperate, or I can TEACH a friend how to cooperate who does not know about cooperating. Put a circle around your best answer.
2. Do you know how to **observe** something? Continue as above if necessary.
3. Do you know how to **record data**?
4. Do you know how to **make a graph**?
5. Do you know how to **make a map**?
6. Do you know how to **measure temperature**?
7. Do you know how to **measure distance** (length)?
8. Do you know how to **measure volume** (liquids)?
9. Do you know how to **measure mass**?
10. Do you know how to **measure time**?
11. Do you know how to **find direction**?
12. Do you know how to **predict things**?
13. Do you know how to **make and use a plan**?
14. Do you know how to **invent something**?
15. Do you know how to **construct things**?
16. Do you know how to **classify things** (sort)?
17. Do you know how to **make a working definition**?
18. Do you know how to **make connections**?

GRADE 2 TEACHER ASSESSMENT (Page 1)

KEY N = No Y = Yes T = Teach															
1. calendar															
2. weather															
3. rainfall															
4. wind															
5. moonset															
6. prediction															
7. time															
8. family															
9. friend															
10. help															
11. biological need															
12. fish anatomy															
13. insect															
14. metamorphosis															
15. predator															
16. soil															
17. pump															
18. root															
19. bulb															
20. activation															
21. protein															
22. vitamin															
23. nutrient															
24. carbohydrate															
25. wellness															
26. microorganism															

GRADE 2 TEACHER ASSESSMENT (Page 2)

KEY N = No Y = Yes T = Teach															
27. safety															
28. 911															
29. wheel															
30. pulley															
31. transportation system															
32. sunlight															
33. shadow															
34. temperature															
35. season															
36. eclipse															
37. recycle															
38. pollution															
39. conservation															
40. decomposition															
41. preservation															
42. organizer															
43. storage															
44. weigh															
45. gram															
46. centimeter															
47. survey															
48. energy															
49. science															
50. technology															

GRADE 2 TEACHER ASSESSMENT (Page 3)

KEY N = No Y = Yes T = Teach															
1. cooperate															
2. observe															
3. record data															
4. graph															
5. map															
6. measure temperature															
7. measure distance															
8. measure volume															
9. measure mass															
10. measure time															
11. find direction															
12. predict															
13. plan															
14. invent															
15. construct															
16. classify															
17. define															
18. make connections															

DASH Grade 2 Concept and Skill Inventory

Name: ____________________

Date: ____________________

Concepts

	CONCEPT	UNDERSTANDING		
1.	calendar	no	yes	teach
2.	weather	no	yes	teach
3.	rainfall	no	yes	teach
4.	wind	no	yes	teach
5.	moonset	no	yes	teach
6.	prediction	no	yes	teach
7.	time	no	yes	teach
8.	family	no	yes	teach
9.	friend	no	yes	teach
10.	help	no	yes	teach
11.	biological need	no	yes	teach

	CONCEPT	UNDERSTANDING		
12.	fish anatomy	no	yes	teach
13.	insect	no	yes	teach
14.	metamorphosis	no	yes	teach
15.	predator	no	yes	teach
16.	soil	no	yes	teach
17.	pump	no	yes	teach
18.	root	no	yes	teach
19.	bulb	no	yes	teach
20.	activation	no	yes	teach
21.	protein	no	yes	teach
22.	vitamin	no	yes	teach
23.	nutrient	no	yes	teach
24.	carbohydrate	no	yes	teach
25.	wellness	no	yes	teach
26.	microorganism	no	yes	teach
27.	safety	no	yes	teach

	CONCEPT	UNDERSTANDING		
28.	911	no	yes	teach
29.	wheel	no	yes	teach
30.	pulley	no	yes	teach
31.	transportation system	no	yes	teach
32.	sunlight	no	yes	teach
33.	shadow	no	yes	teach
34.	temperature	no	yes	teach
35.	season	no	yes	teach
36.	eclipse	no	yes	teach
37.	recycle	no	yes	teach
38.	pollution	no	yes	teach
39.	conservation	no	yes	teach
40.	decomposition	no	yes	teach
41.	preserve	no	yes	teach
42.	organizer	no	yes	teach
43.	storage	no	yes	teach

	CONCEPT	UNDERSTANDING		
44.	weigh	no	yes	teach
45.	gram	no	yes	teach
46.	centimeter	no	yes	teach
47.	survey	no	yes	teach
48.	energy	no	yes	teach
49.	science	no	yes	teach
50.	technology	no	yes	teach

Name: ______________________________

Date: ______________________________

Skills

SKILL	UNDERSTANDING		
1. cooperate	no	yes	teach
2. observe	no	yes	teach
3. record data	no	yes	teach
4. graph	no	yes	teach
5. map	no	yes	teach
6. measure temperature	no	yes	teach
7. measure distance	no	yes	teach
8. measure volume	no	yes	teach
9. measure mass	no	yes	teach
10. measure time	no	yes	teach
11. find direction	no	yes	teach
12. predict	no	yes	teach

SKILL		UNDERSTANDING		
13.	plan	no	yes	teach
14.	invent	no	yes	teach
15.	construct	no	yes	teach
16.	classify	no	yes	teach
17.	define	no	yes	teach
18.	make connections	no	yes	teach

DASH

WEATHER
LOGOS
SP 2.1.1

Name: ____________________

Date: ____________________

LOGO	KIND OF WEATHER

DASH

WONDER AND DISCOVER
SP 2.1.2

Name: ____________________

Date: ____________________

QUESTION:

DISCOVERIES:

DASH

APHORISMS
SP 2.1.3
Page 1

Name: ______________________

Date: ______________________

APHORISMS	UNDERSTAND			USE		
	YES	NO	TEACH	YES	NO	TEACH
1. Eat the basic three, in wide variety.						
2. Slow down sugar, Slow down fat, A dash of salt is enough of that.						
3. Sleep for eight, Wake up feeling great.						
4. Six glass in winter and eight in summer are my body's natural plumber.						
5. Wash hands before eating or fixing a hurt, After using the toilet or working in dirt.						
6. Someone else's dishes Are someone else's germs.						

APHORISMS
SP 2.1.3
Page 2

Name: ______________________

Date: ______________________

APHORISMS	UNDERSTAND			USE		
	YES	NO	TEACH	YES	NO	TEACH
7. Brush twenty times up And twenty times down, Inside, outside, all around. Floss in between To complete the routine.						
8. Healthy skin and hair Are clean skin and hair.						
9. Winter clothes feel comfortably warm. Summer clothes feel comfortably cool.						
Wear white at night.						
10. When nature calls, Listen and go, Wipe and flush, And wash, just so.						
11. A clean and safe space, Is a great workplace.						

DASH

APHORISMS
SP 2.1.3
Page 3

Name: ____________________

Date: ____________________

APHORISMS	UNDERSTAND			USE		
	YES	NO	TEACH	YES	NO	TEACH
12. Mouth in the water, Not in the fountain, Keeps those germs from growing and sproutin'.						
13. When sick stay home Don't let your germs roam.						
14. Don't sneeze or cough With the cover off.						
15. Sharing with others Is caring for others.						
16. Get the job done, Then have fun.						
17. Plan when you can.						
18. Lend a hand, When you can.						
20. Remember 911 When emergencies Come.						

DASH

APHORISMS
SP 2.1.3
Page 4

Name: ______________________

Date: ______________________

APHORISMS	UNDERSTAND			USE		
	YES	NO	TEACH	YES	NO	TEACH
20. Play fair with others And they'll play fair with you.						
21. Finished for today? Then put your things away.						
22. Other things live here too. They need respect from me and you.						

DASH

HELPING MYSELF AND OTHERS
SP 2.1.4

Name: ______________________

Date: ______________________

HOW OFTEN DO I DO IT?	ALWAYS	2nd SEM				
		1st SEM				
	SOMETIMES	2nd SEM				
		1st SEM				
	NEVER	2nd SEM				
		1st SEM				
CAN I DO IT?	TEACH	2nd SEM				
		1st SEM				
	NO	2nd SEM				
		1st SEM				
	YES	2nd SEM				
		1st SEM				
GOAL						

DASH

HELP
SP 2.1.5A

Name: ______________________

Date: ______________________

NEED	WHEN CAN HUMANS FIRST DO IT?	WHEN CAN ANIMALS FIRST DO IT?	
		ANIMAL?	WHEN?

DASH

GETTING HELP
SP 2.1.5B

Name: ______________________

Date: ______________________

NEED	HOW TO GET HELP		
	ASK SOMEONE	PAY SOMEONE	LEARN HOW

DASH

MAKING FRIENDS
SP 2.1.6

Name: ____________________

Date: ____________________

List some good ways to make friends.

NUMBER	IDEA

DASH

TAKING TURNS
SP 2.1.7

Name: ______________________

Date: ______________________

Make a list of rules for taking turns and sharing.

NUMBER	RULE

DASH

SCHOOL FAMILY INTERVIEW
SP 2.1.8

Name: ____________________

Date: ____________________

Name:

QUESTIONS	ANSWERS

DASH

SECRET PREDICTIONS
SP 2.1.9

Name: ______________________

Date: ______________________

PREDICTION		DID IT HAPPEN?	
		YES	NO
1			
2			
3			
4			
5			

SP 2.1.10

DASH

PLANNING
SP 2.1.10

Name: ______________________

Date: ______________________

ACTIVITY:

THE PLAN

DATE	WHAT TO DO

SP 2.1.11

DASH

INVENTOR'S QUESTIONNAIRE
SP 2.1.11

Name: ____________________

Date: ____________________

Ask the following questions about your invention. Check YES if you did the thing asked about and NO if you did not do the thing asked about.

QUESTION	YES	NO
1. Did you stop and think about what you were going to do before you started to work?		
2. Did you work with the things before you got the idea for your invention?		
3. Did you watch what other people were doing to get ideas?		
4. Did you picture in your head what you were going to do?		
5. Did you talk to yourself in your head about what you were going to do?		
6. Did you draw a picture of what you were going to make before you made it?		
7. Did you talk to anyone to see what they thought about your ideas?		
8. Did you write down anything about your invention?		
9. Were you ever unsure as to whether you could make an invention?		
10. Could you make your invention work even better now?		
11. Could you make a different invention that could do the same thing as the one you have just finished?		

LIBRARY CARD
SP 2.1.12

Name: ______________________

Date: ______________________

LIBRARY CODE	
	Title: ____________________
	Author: ____________________
	Subject: ____________________

A short description of the book

____

____

LIBRARY CODE	
	Title: ____________________
	Author: ____________________
	Subject: ____________________

A short description of the book

____

____

DASH

GRADE 2
CLUSTER 2

Time, Weather, and Sky

2.2.1 Temperature
2.2.2 Wind
2.2.3 Sunrise, Sunset, and Seasons
2.2.4 Moonrise and Moonset
2.2.5 Rain
2.2.6 Snow
2.2.7 Digital Time
2.2.8 Analog Time

GRADE 2
ACTIVITY GOALS

CLUSTER 2
Time, Weather, and Sky

2.2.1 Temperature

To continue study and measurement of temperature; to use graphs in summarizing data; to relate temperature to time of day, cloud cover, and seasons; to identify the role of the sun in changing temperature; and to develop observational, recording, and reasoning skills.

2.2.2 Wind

To explore the concepts of wind direction and wind speed; to use the body as a directional compass; to invent and build wind direction and speed indicators; to introduce and use the Beaufort Wind Speed Scale; and to develop observational, problem solving, recording, and reasoning skills.

2.2.3 Sunrise, Sunset, and Seasons

To continue study of sunrise and sunset; to measure and graph the changing lengths of day and night over the school year; to correlate seasonal events with length day and night; and to develop mathematical, recording, and reasoning skills.

2.2.4 Moonrise and Moonset

To continue study of the moon; to graph the risings and settings of the moon; to make predictions and seek answers to questions about the moon cycle; and to develop mathematical, recording, and reasoning skills.

2.2.5 Rain

To invent and make rain gauges; to collect data on the amount of rainfall; to relate rainfall with seasons; and to develop fine motor, recording, problem solving, and reasoning skills.

2.2.6 Snow

To invent and make snow gauges; to collect data on the amount of snowfall; to relate rainfall with seasons; and to develop fine motor, recording, problem solving, and reasoning skills.

2.2.7 Digital Time

To review digital time; to continue to use a digital time line; to prepare for the introduction analog time; and to develop fine motor skills.

2.2.8 Analog Time

To explore the analog clock; to compare digital and analog clocks; to identify advantages of each kind of clock; and to develop fine motor, problem solving, and reasoning skills.

2.2.1 TEMPERATURE

OBJECTIVES

The students

- Measure temperature three times each day.
- Graph daily temperature.
- Make hypotheses and generalizations about temperature and time of day.
- Make hypotheses and generalizations about temperature and seasons.
- Make hypotheses and generalizations about temperature and cloud cover.
- Develop a sense of how the sun affects outdoor temperature.

BACKGROUND

This activity should be started in the first weeks of school during the setting up of the calendar. DASH students begin collecting temperature data in kindergarten. In DASH 1 they began to correlate changes in daily temperature with seasons. Now they add the relationship of temperature and sunlight. There are two aspects to this year's study. First, there are daily temperature variations that will be correlated with the shadow of cloud cover. Second, are seasonal temperature variations that will be correlated with seasonal data. This activity is a companion to Activities 2.2.3 SUNRISE, SUNSET, AND SEASONS and 2.8.4 COMPARING TEMPERATURES.

It is suggested that temperature be taken at the same time and place each day. Ideally, temperature is taken three times—when the students first arrive in the morning, at noon, and right before the students leave in the afternoon. The three temperatures can be put on a single line or bar graph using different colors.

Ideally, the thermometer will be mounted right outside the classroom window so that it can be read from inside. However, in many schools the thermometer is carried outside and read or is in some permanent place.

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STUDENT ROLES

Meteorologist
Mathematician (when graphing)

MATERIALS

chart paper
markers
one-inch graph paper
Wonder and Discover Book
Celsius-Fahrenheit thermometer—large, with each degree marked is preferred
Class Responsibility Chart
Learning Calendar
Student Page 2.2.1 TEMPERATURE AND SUNLIGHT

PRODUCTS

Concept map about temperature
Class chart about temperature predictions
Class graph of daily temperatures
Learning Calendar data
Completed Student Pages

PROCEDURES

1. **Help the students create a class concept map about temperature to assess their prior experience with temperature.**

2. **Introduce the activity with a discussion about the Celsius-Fahrenheit thermometer.**

   Show them a thermometer and ask questions such as these:

   - Can anyone show us the Celsius scale on this thermometer?

   - Can anyone read the Celsius scale?
     ✔ The hands raised in answer to this question will provide a hint for teaming the students to carry out the remainder of the activity.

   - What is the other scale called?

- Can anyone read this scale?
  ✔ This is another question that will help to organize work teams.

3. Have the students make predictions about the temperatures they will measure during the coming year. List the students' predictions and their hypotheses as to why on the class chart about temperature predictions.

Ask such questions as these:

- What do you predict will happen to the temperature during the day if you measure it when you first come in the morning, at noon, and right before you leave in the afternoon? Why?
  ✔ Work to a discussion of why the temperature changes during the day. Record the students' hypotheses.

- When do you predict it will be hottest during the day? Why?
  ✔ There is a natural anomaly here. The hottest part of the day could reasonably be argued to come at the time of most sunlight or noon. However, there is a lag, and the hottest time is most often in the early afternoon. The sun is still warming the earth at noon. The students will discover this. Record all predictions and hypotheses.

- How do you predict that temperatures will compare between times when we have clouds and times when it is clear? Why?

- What do you predict will happen to the temperature as we move from fall, to winter, to spring, to summer? Why?

4. Have the students graph daily temperature data on a class graph.

Have them

- Add temperature data collection to the class Responsibility Chart.
  ✔ The three sets of data, morning, noon, and afternoon can be put on the same graph using different colors for each.
  ✔ Blanks in the data will not affect the results. they will naturally exist over weekends.

5. **Ask the students if they have any other questions they would like to explore about outside temperature.**

   Help them
   - Record their questions, predictions, and hypotheses in the Wonder and Discover Book.

6. **Periodically review the class graph of daily temperatures.**

   Ask such questions as these:
   - Do any of your predictions seem to be right?
   - Have you been able to answer any of the questions you put in the Wonder and Discover Book about temperature and sunlight?
   - Have you other questions you would like to put in the Wonder and Discover Book?

7. **At the end of the year have the students correlate temperature with time of day, seasons, and amount of cloud cover and shadow.**

   Have them
   - Correlate temperature with time of day. Decide how their predictions turned out. Find evidence to support or refute their original hypotheses.
   - Correlate temperature with seasons. Decide how their predictions turned out. Find evidence to support or refute their original hypotheses.
   - Correlate temperature with amount of cloud cover. Decide how their predictions turned out. Find evidence to support or refute their original hypotheses. See Activity 2.8.3 CLOUDS AND SUNLIGHT.

EXTENSION

- Set up a temperature center and have the students report on their own investigations.

2.2.2 WIND

OBJECTIVES

The students
- Construct a wind direction indicator.
- Use a compass to determine the direction north.
- Measure and record wind speed and direction.
- Determine the local wind direction.
- Record wind speed using the Beaufort Wind Scale.

BACKGROUND

This activity is a companion to Activities 2.2.1 TEMPERATURE, 2.2.5 RAIN, 2.2.6 SNOW, and 2.8.4 COMPARING TEMPERATURES. It is usually started after calendar routines have been established.

Students invent and construct a wind vane. Using the wind vane to find wind direction extends work started in DASH 1. Students already have learned how to use the body as a compass with the rhyme and song below.

Body Compass Rhyme	**Body Compass Song** Sung to the tune of *When Johnnie Comes Marching Home*
Right, rising east. Left, leaving west. Nose north. Seat south.	The sun is rising in the east, the east, the east. The sun is setting in the west, the west, the west. My nose is north, my seat is south, And earth can turn itself about. The sun is rising in the east and setting in the west.

Here the students use a magnetic compass to verify direction and locate north when the sun is not shining. DASH 1 students made their own magnetic compass using a magnetized steel nail in a cork that floats in a shallow dish of water. These experienced students may now be able to help others make such a compass.

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In this activity an abbreviated Beaufort wind speed scale is introduced that will help the students quantify wind speed observations. The Beaufort scale allows the students to look at things that are moved by wind an get an approximation of the wind's speed.

In previous years the students have used the angle of a wind sock, flag, or other detector to estimate relative wind speeds—no wind, light wind, moderate wind, and high wind. Here they are asked to invent a wind speed detector that can be standardized using the Beaufort wind speed scale.

STUDENT ROLES

Inventor
Meteorologist

MATERIALS

cardboard
stiff wire
wood blocks
hammer
plastic pen tops
waterproof tape
cork or Styrofoam
plastic dish
steel nail or large sewing needle
strong magnet
pliers
scissors
magnetic compass
plastic wrap
compass card
Student Page 2.2.2A WIND
2.2.2B BEAUFORT SCALE

PRODUCTS

Wind speed detector
Wind vane
Learning Calendar record of wind speed and direction
Completed Student Pages

PROCEDURES

1. **On a windy day very early in the year introduce the activity.**

   Ask such questions as:
   - How do you know when it is windy? What do you see, what do you feel?
   - What do we mean when we say we have a north wind? A west wind?
     ✔ Work to the idea that the wind is coming *from* that direction.
   - Has anyone ever seen a wind vane? What does it tell us?

2. **Ask the students how they can find the directions north, south, east, and west.**

   - Review the Body Compass Rhyme and Song.
   - Ask how else you can find directions.
     ✔ Work to the idea of using a magnetic compass.
   - Ask if anyone can make a magnetic compass for us.
     ✔ Have a small group make a magnetic compass from a cork or piece of Styrofoam and a nail. Alternatively provide one.
     ✔ Remind the students that they need to float their compass in a ceramic or plastic bowl.

3. **Show the students an example of a wind vane and have them plan to invent and make their own wind direction finders.**

   Have them consider that
   - The vane should move freely through 360 degrees.
   - The free movement can be produced by a nail pivoting in a solid sleeve. (Pen top, test tube, etc.)
   - The base needs a compass card similar to the one on their Student Page 2.2.2 WIND.
   - They can cut out and attach the card to the base of their wind vane.

- They need to take into account that wind direction will have to be taken on rainy as well as dry days.
  ✔ Work to the idea of covering things with plastic.

4. **Have the students make and test their wind vanes.**

   Have them
   - Orient their wind vanes first using their body compass then a magnetic compass.
   - Note that the wind vanes will act differently when they are placed next to buildings than when they are in the open.
   - Agree upon a common spot where the wind direction is to be taken each day.

5. **Introduce the Beaufort Scale to the class using Student Page 2.2.2B BEAUFORT WIND SCALE.**

   Working outside, have the students
   - Arrive at a consensus on the speed of different gusts.
   - Arrive at a consensus as to the average speed—the speed most of the time.

6. **Have the students invent a device to measure wind speed and standardize it using the Beaufort scale.**

7. **Have the students record the daily wind speed and direction on the Learning Calendar.**

8. **At the end of each season review the wind speed and direction data with the students.**

   Ask such questions as these:
   - What kind of weather do we have when the wind seems to be the fastest? When it blows slowly or not at all?
   - What was the fastest wind that we had?
   - What was the speed of the wind most of the time?
   - What direction does the wind seem to blow most of the time?
   - What do you think the wind will be like in the next season?

EXTENSION

- Have the students look into ways that wind speed is measured by the Weather Bureau.

2.2.3 SUNRISE, SUNSET, AND SEASONS

OBJECTIVES

The students
- Use newspaper, internet, or almanac information to record sunrises and sunsets on the Learning Calendar.
- Measure the time interval between sunrise and sunset.
- Graph the amount of daytime and nighttime.
- Discover the solstices and equinoxes.
- Relate solstices and equinoxes to seasons.

BACKGROUND

Keeping track of sunrises and sunsets is introduced in DASH 1 and continues in DASH 2. It is done concurrently with Activities 2.2.7 DIGITAL TIME and 2.2.8 ANALOG TIME.

Use newspaper, the internet, or almanac information to record sunrises and sunsets on the Learning Calendar. If the almanac is used take data for the nearest latitude.

In SUNRISE, SUNSET, AND SEASONS the students make a graph showing the amount of daytime (sunrise to sunset) and the amount of nighttime. From this they find correlations between the amount daytime and nighttime and seasonal changes. The dates when seasons change occur are discovered. To get an adequate sense of the times of seasonal change, data need only be graphed once a week. To make precise the dates of seasonal change, data can be graphed daily during the times of the equinoxes and solstices.

These times of season change will be found to be at the *Autumnal Equinox* on or about September 23; the *Winter Solstice*, on or about December 21; the *Spring* or *Vernal Equinox* on or about March 20; and *Summer Solstice* on or about June 21. Check with an almanac or the internet for exact dates. Dates of each event vary a day or so from year to year because of leap years and other astronomical adjustments. If DASH is being used in the southern hemisphere the seasons will be reversed but the dates will remain the same.

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For students who did not have DASH 1 it will be necessary to introduce them to the ideas of sunrise and sunset. Where possible, pair students who understand the rising and setting of the sun with those who are dealing with the topic for the first time. See DASH 1 Activity 1.2.8 NIGHT AND DAY.

This activity should be started as early as possible in the school year.

STUDENT ROLE

Astronomer

MATERIALS

1 inch grid paper for graphing
markers
digital clock
newspaper, internet, almanac, or calendar data on sunrise and sunset
Learning Calendar
Connections Book
Student Page 2.2.3 SUNRISE, SUNSET, AND SEASONS

PRODUCTS

Class graph of amount of daytime and nighttime
Class chart of questions and predictions about sunrise, sunset, and seasons
Completed Student Pages

PROCEDURES

1. **Introduce the activity with a discussion about sunrise and sunset.**

   Ask such questions as these:
   - How can we tell when the sun rises? When the sun sets?
   - Where do we look to find the rising sun? The setting sun?
   - If we were looking for the next sun to rise, what part of the sun might we see first?
     ✔ The students will have to conceptualize the shape of the sun.
     ✔ To help, cut out a circle to simulate the sunrise.

- If we were looking for the next sunset, what would we see last?
- When can we say that daytime starts and ends?
  ✔ Work to the idea that we can use sunrise to sunset for the measurement of daytime and the rest of the time is nighttime.

2. **Have the students create a list of predictions and questions about things that happen during different seasons. Record their predictions and questions on a class chart.**

   Help them include such questions as:
   - What do you think happens to the temperature during different seasons?
   - What do you think happens to the weather during different season?
   - What do you think happens to animals during different seasons?
   - What do you think happens to plants during different seasons?
   - What do you think happens to people during different seasons?
   - What do you think happens to the ground during different season?

3. **Have the students start collecting sunrise and sunset data early in September and immediately analyze them.**

   Have them
   - Measure the time intervals between sunrise and sunset (the amount of daytime). The remainder of the time is the amount of nighttime. See Activity 2.2.7 DIGITAL TIME.
   - Record the amount of daytime and nighttime on Student Page 2.2.3 SUNRISE, SUNSET, AND SEASONS.
   - Make a class graph on amount of daytime and nighttime.

4. **Discuss the collected data by about September 16, a week before the Autumnal Equinox (on or around September 23).**

   Ask such questions as these:
   - What is happening to the amount of the nighttime? The amount of the daytime?

- What prediction can we make about the amount of daytime and nighttime tomorrow? A week from now? Two weeks from now?
  ✔ Work for prediction of a date of equal amounts of daytime and nighttime.
  ✔ Introduce the term *equinox.*

- When would do you predict there will be equal amounts of daytime and nighttime?

5. **On the equinox, the first day of fall, have a "Fall or Vernal Equinox party" with the class. Record the equinox on the Learning Calendar and on the graph.**

6. **In December, before the 15th, hold a class graph analysis session of the length of day and night data. Record predictions on the class chart.**

   Ask such questions as these:
   - What is happening to the length of the night? The length of the day?
     ✔ Asking about *night* before *day* is here an intentional switch. Students usually have more experience with daytime. By asking them to focus on the less familiar first, we are pushing them to stretch their thinking in a new direction.

   - What predictions can you make about the length of night and day tomorrow? A week from now? Two weeks from now? When we get back from vacation? Record predictions.

7. **On return from winter vacation discuss the class data.**

   Have the students
   - Find the Winter Solstice, the first day of winter and the shortest day of the year (on or around December 21). Record this on the Learning Calendar and the class graph.
     ✔ Introduce the term *solstice.*

   - Relate graphed temperature data from Activity 2.2.1 TEMPERATURE.

   - Review their questions about seasons.

8. **In March, before the 15th, have a session to analyze the graph.**

Ask such questions as these:

- What is happening to the length of the night? The length of the day?
- What predictions can you make about the length of night and day tomorrow? A week from now? Two weeks from now? Record predictions.
  ✔ Shape questions to get at the prediction of a date of equal night and day or the Vernal or Spring Equinox.
- What date do you think will have night and day of equal length?
  ✔ Record predictions on the class chart.

9. **On the first day of spring, the Spring Equinox (on or around March 20) hold a class "Spring Equinox party."**

Have the students

- Relate temperature charts.
- Note on the Learning Calendar and the graph.
- Work on their seasonal questions.

10. **Have a class session near the end of the school year to summarize the investigation. Record their ideas in the Connections Book.**

Ask such questions as these:

- What is happening to the length of the night and day now?
- How long do you predict this pattern will continue? Why?
- What is happening to the temperature outside?
- What seems to be the relationship between temperature and the length of day?
  ✔ Have the students complete answering their questions about seasons.
- Why is it important to learn about weather? Seasons?
- Who needs to know about weather? Seasons?
- Where else might you use what you have learned about weather? Seasons?

EXTENSIONS

- Have the students invent rhymes to remember the dates of the solstices and equinoxes as related to the seasons.
- Have the students continue to collect data over the summer.

2.2.4 MOONRISE AND MOONSET

OBJECTIVES

The students
- Observe and record times of moonrise and moonset.
- Use newspaper, internet, or almanac information to record moonrises and moonsets on the class calendar.
- Graph moonrises and moonsets.

BACKGROUND

In this activity students keep track of moonrises and moonsets. If students are new to DASH you may need to review the moon phases. See Kindergarten DASH Activity K.2.7 MOON PHASES.

Introduce the recording of the time of moonrise and moonset after students have started to record sunrise and sunset data on the calendar. After observing the moon, the students get data each day from newspapers, the internet, tide or fishing calendars, or almanacs. They create a series of questions about the moon cycle and then proceed to graph the times of moonrise and moonset to find answers.

STUDENT ROLES

Astronomer
Mathematician

MATERIALS

digital clock
newspaper, the internet, calendar, or almanac data on
  moonrise and moonset
Learning Calendar
chart paper
1 inch graph paper
markers
Wonder and Discover Book
Student Page 2.2.4 MOONRISE AND MOONSET TIMES

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PRODUCTS
Concept map about the moon
Class list of questions about the moon cycle
Class graph of moonrise and moonset
Completed Student Pages

PROCEDURES

1. **Set the stage for moon study by having student groups make concept maps about the moon. Share and discuss their maps.**

2. **Have the students observe the moon during school time. Then using their concept maps help them develop a series of questions about the moon cycle. Record these on a class list.**

   Include such questions as these:
   - What are the moon's phases?
   - In what sequence do the moon phases take place?
   - About how long does one moon cycle take?
   - How might we tell when the moon rises? The moon sets?
   - Where might we look to find the rising moon? A setting moon?
   - If we were looking for the next moon to rise, what part of the moon might we see first?
   - Does the moon rise at the same time as the sun? Set at the same time?
   - Is the moon in the sky as long as the sun is in the sky?

3. **Help the students set up procedures to record moonrise and moonset times on the Learning Calendar. If they do not find this information on their own, bring in a newspaper or use the internet, a calendar, or an almanac for data.**

4. **Help the students set up a class graph of moonrise and moonset on 1 inch grid paper. Graph every day. Use different colors for the time the moon is in the sky and not. Colors other than black and yellow will help lessen confusion with their daytime and nighttime graph.**

5. **Continue graphing through the second moon cycle.**

   Have the students
   - Determine the total time of a moon cycle.
     ✔ Work for 29 or 30 days.
   - Use their graph to answer questions on their list.

6. **Have the students make a tube of their moon graph to show the actual progress of the moon day to day.**

   Ask such questions as these:
   - What does the tube graph show about the movement of the moon?
   - How many days does it show are necessary for the moon to go through its cycle, or get back to its starting point?
   - Have the students go back and discuss answers to the questions they put on the class list of questions about the moon cycle and the sun.
     ✔ Record any additional or unanswered questions in the Wonder and Discover Book.

EXTENSION

- Have the students compare their graph of moonrise and moonset with those of previous years. Have them note that the dates of the moon cycle are different.

2.2.5 RAIN

OBJECTIVES

The students
- Invent and make rain gauges.
- Measure and record the depth of rainfall.
- Compare the depth of rain falling in different places.
- Compare the depth of rain falling in different seasons.

BACKGROUND

This activity is a companion to Activities 2.2.1 TEMPERATURE, 2.2.2 WIND, 2.2.6 SNOW, and 2.8.4 COMPARING TEMPERATURES. Start it on a rainy day after the calendar is well established.

Gauges
In *DASH* 2 rain gauges are made from tin cans, milk cartons, and other kinds of containers that have straight sides.

Purpose
RAIN introduces the measurement of rainfall. Equally important, it helps the students discover that certain procedures in operating a measuring instrument work better than others and that procedures must be standardized if consistent data are to be collected.

Location and Measurement
Initially students set up rain gauges at various places on the school grounds. They will discover that the *best* situation for a rain gauge is in a location where there are no obstructions and it will not be bothered. Gauges under eaves and trees and on the sides of buildings get less water than gauges that are in the open. Once a place is found for a gauge, it should be kept there. Measurements should be made at the same time each day, water depth should be measured the same way, and the gauge should be emptied after each reading.

Gauges that are in accessible areas are likely to be vandalized. Suggestions for protecting gauges should be offered only as a last resort.

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Here is a place for students to be very inventive and develop respect for other students projects.

Records
Records of rainfall are kept on the Learning Calendar and on a class graph. Have the students discuss ways of measuring water depth and how to graph these data. Report depth of rainfall in inches to correspond to weather reports.

Irregular Containers
The problem involved in using irregular containers (containers with rounded bottoms, wasp waists, or conical sides) is not confronted here. These problems will be dealt with in DASH 4. All cans used as gauges should have straight sides (tin cans, milk cartons).

Depth of Rainfall
In this activity the students discover that during the same rainfall, straight sided containers collect about the same depth of water no mater how large their opening. Treat this as a fact. Explanation will emerge later in DASH 4.

STUDENT ROLES

Inventor
Meteorologist

MATERIALS

tin cans with straight sides
wax coated cardboard containers with straight sides
stiff wire such as coat-hanger wire
rulers
waterproof tape
pliers
strips of construction paper to act as dip sticks
glue
pencil
grid paper for graph
Student Page 2.2.5 RAINFALL

PRODUCTS

Rain gauges
Learning Calendar record of rainfall
Class graph of weekly or monthly rainfall
Completed Student Pages

PROCEDURES

1. **On a rainy day introduce the collection of rainfall data to the students.**

   Ask such questions as these:
   - How might you measure how much rain falls?
   - If you put a container outside in the rain, what do you think will happen?
   - How is the amount of rain reported on TV and in the newspapers?
     ✔ Have the students report back. Measurements are stated in inches of rainfall.

2. **Have the students put out straight sided cans of different sizes in a place where they will get the same depth of rain. Leave them long enough to collect a measurable amount of rain.**

3. **Have the students invent a way to measure the depth of water in inches. If needed, demonstrate a dipstick method of putting a strip of construction paper in the can and measuring the depth.**

4. **Compare the depths of water measured.**

   Ask such questions as these:
   - What happened when you put the cans in the rain?
   - How do the depths of water compare?
     ✔ They will be about the same depth.
   - Could you use the depth of the water to tell us about how much rain has fallen?

- Can you think of other situations in which you use depth when you talk about the amount of liquid you have?
  ✔ How much water there is in a stream? How deep is a swimming pool?

5. **Have the students invent rain gauges. Discuss with the students how they will use their gauges.**

   Ask questions such as these:
   - When should you check the gauge? Why?
   - How often should you measure the water in the gauge?
   - Should all gauges be checked at the same time or at different times? Why?
   - After you have measured the water in the gauge, should you leave the gauge full? Should you empty it? Why?

6. **Discuss with the students where they are going to put their rain gauges and help secure them.**

7. **After the first measured rain have the students collect data and record them on Student Page 2.2.5 RAINFALL.**

   Compare data and ask such questions as
   - Did every group measure the same depth of rain in their gauge?
   - Did any groups get more than others? Why?
   - What are you trying to measure?
     ✔ Get at the idea that you want to get a measure of the water falling directly from the sky, not from a rain spout or off the roof.
   - Does anyone want to change the location of his or her gauge? Why?

8. **After the second rain, establish standards for the rain gauge with the students.**

   Ask such questions as these:
   - Did every group measure the same depth of rain?
     ✔ Measurements should now be about the same.
   - Which groups got the most rain? Why?

- Where were their gauges located?
- What do you want our gauges to measure?
- Where are the best kinds of places to locate rain gauges?

9. **Have the students again relocate the rain gauges and begin data collection. Have them record the data on the calendar and on Student Page 2.2.5 RAINFALL.**

10. **Make a bar graph of the rainfall each week or month and discuss the rain fall.**

    Ask such questions as these:
    - When was the heaviest rain?
    - How often did it rain?
    - Do you predict that there will be more, less, or the same depth of rain next week or month?

11. **At the end of the school year have the students compare these data and relate them to other weather data on the calendar.**

    Ask such questions as these:
    - What was the wettest season?
    - What was the driest season?
    - How do you predict that the summer season will compare with other seasons?

EXTENSION

- Help the students organize a "Rainy Days Club" to measure and record the depth of rain that falls at their home.

2.2.6 SNOW

OBJECTIVES

The students
- Invent snow gauges.
- Measure and record the depth of snowfall.
- Compare the depth of snow falling in different places.
- Compare the depth of snow falling in different seasons.

BACKGROUND

This activity is a companion to Activities 2.2.1 TEMPERATURE, 2.2.2 WIND, 2.2.5 RAIN, and 2.8.4 COMPARING TEMPERATURES. Start it on the first snowy day after Learning Calendar routines have been established.

It is assumed that in most places students will have experience in collecting rain data before they begin to deal with snow. A similar tin-can gauge can be used. However, allow students to invent their own gauge. Have your gauge on hand to be used only if needed to act as a model. If there is particularly heavy snow a yard or meter stick placed in the snow will give a direct measurement.

The liquid water content of snow can be found by bringing the snow indoors and letting it melt. Water depth can be measured by the dipstick method or a ruler can be used as in Activity 2.2.5 RAIN.

STUDENT ROLES

Inventor
Meteorologist

MATERIALS

tin cans with straight sides
waxed cardboard cartons
strips of construction paper
waterproof tape

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glue
pencil
stiff cardboard
rulers
grid paper for graph
Student Page 2.2.6 SNOWFALL

PRODUCTS

Snow gauges
Learning Calendar record of snowfall
Class graph of weekly or monthly snowfall
Completed Student Pages

PROCEDURES

1. **Introduce the activity on the first day of snow.**

   Ask such questions as these:
   - How could you measure how much snow has fallen?
   - How did you measure rain?
   - Can anyone invent a way to measure the depth of snowfall?
     ✔ Get at such things as pushing a stick into the snow and measuring the depth or leaving a can outdoors as they did with rain.
   - How could you compare the depth of water in the snow with the water in rain?
   - Can anyone invent a way of measuring the water in snow using a tin can?
     ✔ Get at such things as putting snow to the same depth as they measured and melting it.

2. **Have the students measure the depth of snow and water content using their own methods. Compare their results.**

   Ask such questions as these:
   - Did every group get the same snow depth? Why?
     ✔ Different depths of snow will collect in different places.
   - Did every group get the same depth of water? Why?

- How can we get the best measurements of snow depth and snow water next time?
- After we measure the snowfall, how can we measure how much snow falls afterwards?

3. **At the end of each week or month with snowfall have the students record and make a graph of the total depth of snowfall and water content.**

   Ask such questions as these:
   - When was the biggest snowfall?
   - How often did it snow?
   - Is all snow alike?
   - Does some snow contain more water than other snow?
   - What do you predict the snowfall will be in the next week or month? More snow? Less snow? Why?
   - How good were your predictions this last week or month?

4. **Have the students compare data and relate them to other weather data on the calendar at the end of the school year.**

   Ask such questions as these:
   - What was the snowiest season?
   - Do we get more water from snow or rain? Why?
   - Do we always get the same depth of water from the same depth of snow?

EXTENSIONS

- Have the students use magnifiers to look at snowflakes.
- Have the students explore to see whether they can predict ahead of time how much liquid water will be in the snow in their snow gauges.

2.2.7 DIGITAL TIME

OBJECTIVES

The students
- Review how to read a digital clock.
- Make a 24 hour digital time line.
- Learn how to use a digital time line to find the time between events.
- Calculate the time between events.

BACKGROUND

Digital time is introduced in DASH 1. Now students learn to calculate lapsed time or the time between start and finish using multiple time lines. In the DASH 2 we also introduce analog time for the calculation of time lapse.

Review

DIGITAL TIME is designed to be used with Activities 2.2.3 SUNRISE, SUNSET, AND SEASONS, 2.2.4 MOONRISE AND MOONSET, and 2.2.8 ANALOG TIME. Digital and analog clocks are tools. In keeping with the general philosophy of DASH, the use of tools is taught in the context of an activity in which the tools are used. Such an approach provides the students with an immediate reason for mastery of the tool and an environment in which to explore and practice its use.

The 24 Hour Time Line

Two common methods of reporting time are in two 12 hour intervals before and after noon (A.M. and P.M.) and in one 24 hour interval. The later is used extensively by the military. Both methods are used here. Conceptually the 24 hour interval is actually easier for students to grasp and can be used before introducing the A.M. and P.M. method.

No DASH 1 Background

Some students probably will not have had DASH 1, so this activity may be their first exposure to digital time. It will accelerate mastery if these students are paired with students who have previously worked with digital time.

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Time Intervals
Time intervals can be determined by using two time lines. Use one time line to mark the beginning and end of the interval to be measured. Use the second timeline as a ruler. Place the 0 hour of the ruler at the beginning of the interval and then measure the number of hours and minutes to the end of the interval.

STUDENT ROLES

Astronomer
Mathematician

MATERIALS

digital class clock
digital watches
scissors
glue
pencils
markers
Student Page 2.2.7 DIGITAL TIME LINE

PRODUCTS

Time lines

PROCEDURES

1. **Introduce the activity by showing a digital clock.**

   Ask such questions as these:
   - Can anyone tell us what time it is now? Reset the clock and repeat the question several times.

   - Can anyone tell us how to read a digital clock?

   - Go to the P.M. readings. Can anyone tell us what P.M. stands for?
     ✔ Work for two ideas—the literal translation, *post meridian*, meaning after the sun passes overhead at noon, and that it tells us when it is afternoon and evening.

- Go to the A.M. readings. Can anyone tell us what A.M. stands for?
  ✔ Work for two ideas—the literal translation, *antemeridian*, meaning before the sun passes overhead at noon, and that it tells us when it is morning.

- Can anyone tell us when the clock changes from A.M. to P.M.? What time is that?
  ✔ Work for noon.

- Can anyone tell us when the clock changes from P.M. TO A.M.? What time is that?
  ✔ Work for midnight.

2. **Introduce Student Page 2.2.7 DIGITAL TIME LINE. Each time line will require 8 copies, there being 3 strips on a copy. One strip equals one hour.**

   Help the students
   - Assemble their time lines.

   - Label A.M. and P.M. on the time line.
     ✔ A different colored stripe along one edge of the timeline can be used for A.M. and P.M.

   - Number as a 24-hour digital time line.

3. **Use the digital time line with Activity 2.2.3 SUNRISE, SUNSET, AND SEASONS and 2.2.4 MOONRISE AND MOONSET to measure the time between rising and setting events. Two or more time lines will be needed.**

   Have the students
   - Mark the time of rising and setting on one time line.

   - Use another timeline to measure the interval between rising and setting.

EXTENSIONS

- Suggest to parents that an analog watch makes an ideal present for students.

- For students who have both an analog and a digital watch, suggest that they wear both. Form a "Two-Watch" club.

- Label one class timeline with both 24 hour time and A.M. and P.M. times for easy conversions from one system to the other.

2.2.8 ANALOG TIME

OBJECTIVES

The students
- Relate digital time readings to analog time readings.
- Construct a model of an analog clock.
- Explore the use of the analog clock.
- Practice using the analog clock.

BACKGROUND

The digital clock was introduced in DASH 1 and is use in DASH 2. In DASH 2 the analog clock is introduced for the first time. DASH employs this sequence because the digital clock is usually much easier for students to learn and many have prior experience with it. Knowing how to read digital time makes analog time much easier to master. However, there are disadvantages to digital clocks. They are unidirectional; one can read only time after the hour directly from a digital clock and one has to perform mental arithmetic to calculate time before the hour. Further digital clocks are not always available and students need to know both systems.

In keeping with the general philosophy of DASH concerning the teaching of tools, time is taught in a context in which it is used. The analog clock can readily be introduced whenever an activity involves time. Practice is natural whenever the time of day needs telling.

ANALOG TIME should follow 2.2.7 DIGITAL TIME. It should not be introduced until newcomers to DASH have gained some proficiency in reading digital time. To ensure that the analog clock is used, it is suggested that any digital clocks be removed from the room while the reading of analog clocks is being mastered.

STUDENT ROLE

Timekeeper

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MATERIALS

time lines from Activity 2.2.7 DIGITAL TIME
analog clock
paper plates for clock faces (preferably without indentations in rim)
paper fasteners
index cards to make hands
scissors
pencil
Student Page 2.2.8 ANALOG CLOCK

PRODUCTS

Analog clocks

PROCEDURES

1. **Set the stage by announcing that because we have to give up our digital clocks and rely upon analog clocks for the next month, the students will need to learn to read an analog clock.**

   Ask such questions as these:
   - Does anyone know what an analog clock is?
   - Does anyone know how to read an analog clock?
     ✔ Those who do can be your assistants.

2. **Turn a digital time line into an analog clock by shaping it into a circle and adding hands. Ask what has been made?**

3. **Have the students make a 12-hour analog clock face using Student Page 2.2.8 ANALOG CLOCK.**

   Have them
   - Cut out the face and glue it to a paper plate.
   - Attach the minute hand with a brass paper fastener.

4. **Have the students inspect their analog clocks.**

   Help them
   - Recall that there are 60 minutes in an hour.

- Discover that there are 12 large lines on the clock face for numbers.
  ✔ Have them write in the numbers 1–12 on their clock face.

- Discover that there are 12 groups of 5 minutes each represented on the face and that their total is 60 minutes.
  ✔ Practice counting by five's.

- Discover that they can count by 5 and single minutes to find the total number of minutes past the hour.
  ✔ Practice with different settings.

5. **Have the students remove the fastener and add the hour hands to their clocks and practice time settings.**

   With them
   - Go over hour settings for one o'clock and two o'clock, then help the students discover other hour settings.

   - Introduce a setting for 5 minutes after one o'clock, then help the students discover the remainder of the series of minutes in-5 minute intervals.

   - Help the students discover how to set the clock for other intervals by giving them practice challenges.
     ✔ Have students help each other.

   - Introduce half and quarter hours.

   - As soon as possible get the students to use their new knowledge in the role of Time Keepers.

6. **When the students are proficient, help them discover that analog clocks can also be read in terms of minutes *before* the hour. Have the students use their clocks.**

   Ask such questions as these:
   - If someone asks *How many minutes is it before twelve o'clock?* when the clock reads 45 minutes after eleven, how could you figure out the answer?
     ✔ Have students help each other to solve this and other such challenge times.

   - When might we want to know how long it will be before twelve o'clock?
     ✔ Practice before-the-hour readings.

EXTENSIONS

- Have the students play Time-Set games.
  Game 1. Give the students a challenge time of so many minutes *after* the hour. Allow them 30 seconds to set their clocks. After a while give them 25 seconds to set them, then 20 seconds and so forth down to about 10 seconds.

  Game 2. Give the students a challenge time of so many minutes *before* the hour. Allow them 30 seconds to set their clocks. After a while give them 25 seconds to set them, then 20 seconds and so forth down to about 10 seconds.

SP 2.2.1

DASH

TEMPERATURE AND SUNLIGHT
SP 2.2.1

Name: ______________________

Date: ______________________

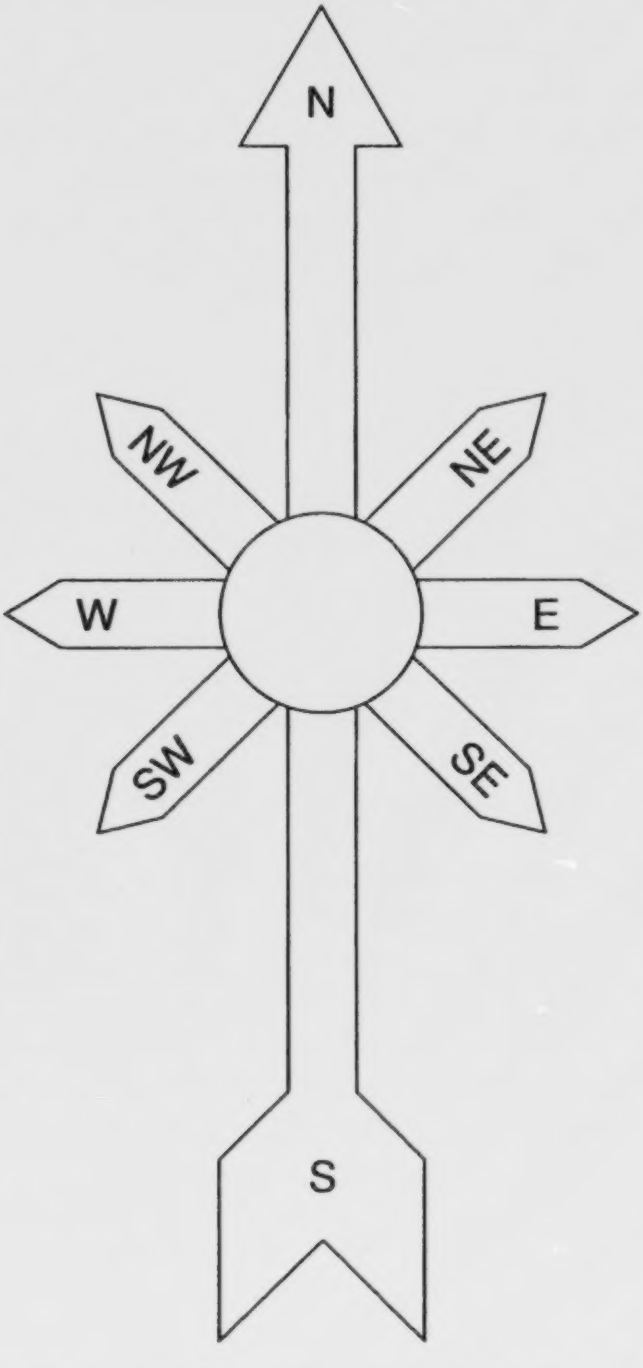
DATE	TEMPERATURE 1			TEMPERATURE 2			TEMPERATURE 3		
	TIME	°C	°F	TIME	°C	°F	TIME	°C	°F

DASH

WIND
SP 2.2.2A

Name: ______________________

Date: ______________________


N
NW
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E
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DASH

BEAUFORT WIND SCALE SP 2.2.2B

Name: ______________________

Date: ______________________

SCALE	MPH	KPH	INDICATORS	KIND	LOGO
0	0–1	0–2	Smoke goes straight up	Calm	
1	2–12	3–20	Smoke drifts sideways, leaves rustle, leaves and twigs in motion	Gentle	
2	13–24	21–40	Small branches move, papers and dust fly, water ripples, small trees sway	Moderate	
3	25–38	41–64	Large branches move, trunks of trees bend, walking is affected	Strong	
4	39–54	65–90	Twigs broken off, shingles carried away	Gale	
5	55–75	92–125	Trees uprooted, widespread damage	Storm	
6	Over 75	Over 125	General disaster	Hurricane Tornado	

SUNRISE, SUNSET, AND SEASONS
SP 2.2.3

Name: ______________________

Date: ______________________

DATE	SUNRISE	SUNSET	AMOUNT OF DAYTIME	AMOUNT OF NIGHTTIME	DATE	SUNRISE	SUNSET	AMOUNT OF DAYTIME	AMOUNT OF NIGHTTIME

SP 2.2.4

DASH

MOONRISE AND MOONSET TIMES
SP 2.2.4

Name: ____________________

Date: ____________________

DATE	MOONRISE ☽↑	MOONSET ☽↓	DATE	MOONRISE ☽↑	MOONSET ☽↓

DASH

RAINFALL
SP 2.2.5

Name: ______________________

Date: ______________________

DATE	AMOUNT OF RAIN	DATE	AMOUNT OF RAIN	DATE	AMOUNT OF RAIN

DASH

SNOWFALL
SP 2.2.6

Name: ______________________

Date: ______________________

DATE	AMOUNT OF SNOW	AMOUNT OF MELTED SNOW	DATE	AMOUNT OF SNOW	AMOUNT OF MELTED SNOW

DIGITAL TIME LINE
SP 2.2.7

Name: ______________________

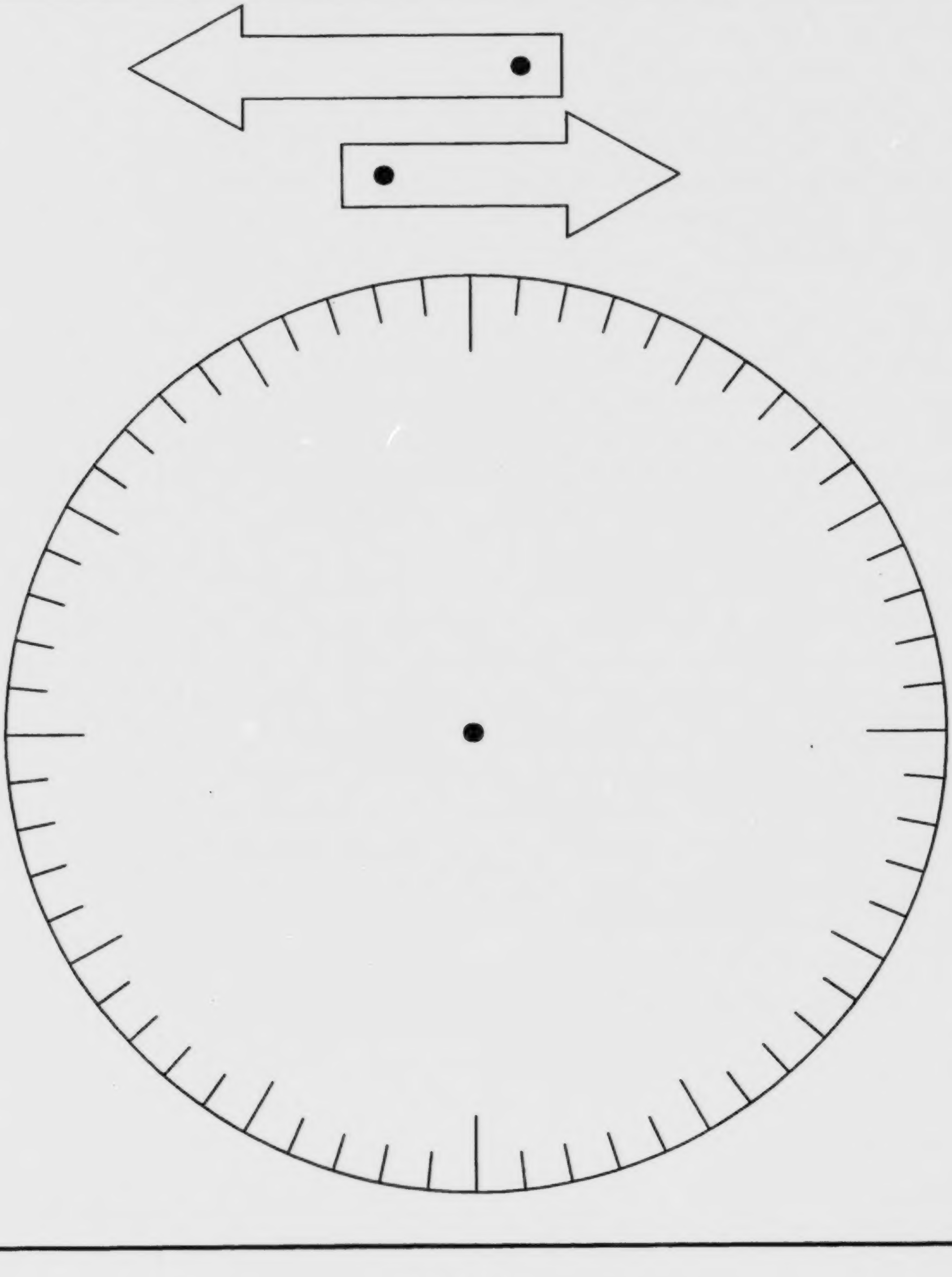
Date: ______________________

GLUE	GLUE	GLUE

ANALOG CLOCK
SP 2.2.8

Name: ______________________

Date: ______________________



DASH

GRADE 2
CLUSTER 3

Animals

2.3.1 The Classroom Aquarium
2.3.2 External Anatomy of Fish
2.3.3 Biological Needs of Fish
2.3.4 Reproduction and Development of Fish
2.3.5 Finding Insect Eggs
2.3.6 Hatching Insect Eggs
2.3.7 Early Metamorphosis
2.3.8 Late Metamorphosis
2.3.9 Collecting Spiders
2.3.10 Spider Food
2.3.11 Spider Care
2.3.12 Spiders as Predators
2.3.13 Spider Webs
2.3.14 Classroom Pets

GRADE 2
ACTIVITY GOALS

CLUSTER 3
Animals

2.3.1 The Classroom Aquarium
To setup and maintain a classroom aquarium; to observe the behavior of aquatic animals; and to develop mechanical and observation skills.

2.3.2 External Anatomy of Fish
To continue studies of the anatomy of animals; to identify the forms and functions of body parts; and to develop observation and recording skills

2.3.3 Biological Needs of Fish
To continue studies of biological needs; to identify the biological needs of fish; and to develop prediction, observation, recording, and reasoning skills.

2.3.4 Reproduction and Development of Fish
To continue studies of reproduction; to observe the reproduction process in fish; to observe the development of fish; and to develop observation and recording skills.

2.3.5 Finding Insect Eggs
To continue studies of reproduction; to collect insect eggs; to relate the nature of environments and different kinds of inset eggs; and to develop observation, recording, and reasoning skills.

2.3.6 Hatching Insect Eggs
To continue studies of reproduction; to observe the early stages of insect development from egg to larva or nymph; and to develop observation, recording, and reasoning skills

2.3.7 Early Metamorphosis
To continue studies of reproduction; to observe the early stages of insect development from larva to pupa; and to develop observational, recording, and reasoning skills.

2.3.8 Late Metamorphosis

To continue studies of reproduction; to observe the middle stages of insect development from pupa to adult or the molting of nymphs; to develop a respect for life and natural environments; and to develop observation, recording, and reasoning skills.

2.3.9 Collecting Spiders

To begin study of spiders; to identify body parts; to observe the behavior of spiders in the wild; and to develop observation and recording skills.

2.3.10 Spider Food

To determine what spiders eat; to observe spiders eating; and to develop observation, recording, and reasoning skills.

2.3.11 Spider Care

To care for captive spiders; to observe their behavior; to develop a respect for life and natural environments; and to develop observation, recording, and reasoning skills.

2.3.12 Spiders as Predators

To observe spiders spinning webs and capturing food; and to develop observation, and recording skills.

2.3.13 Spider Webs

To test the strength of spider webs and to develop inventing and measuring skills.

2.3.14 Classroom Pets

To continue contact with classroom pets; to continue building and understand of our human responsibility for domestic and captive animals; to deepen respect for life; and to develop fine motor, observation, organizational, and recording skills.

2.3.1 THE CLASSROOM AQUARIUM

OBJECTIVES

The students
- Assemble aquariums.
- Add organisms to their aquariums.
- Observe the organisms.
- Maintain the organisms in the aquariums.

BACKGROUND

THE CLASSROOM AQUARIUM should be accompanied or preceded by Activity 2.3.14 PET CARE and followed by 2.3.2 EXTERNAL ANATOMY OF FISH.

A decision will be required as to whether to have groups assemble several aquariums or to have the entire class make and maintain one large classroom aquarium and a small one for short-term experiments. Equipment availability will probably dictate what is done. Most pet stores sell aquariums and all the basic supplies as a package.

Freshwater Aquarium

A freshwater tank is usually preferable to a saltwater one from the standpoint of lower cost and greater ease of maintenance. The following discussion assumes the use of fresh water.

Chlorine in Water

If the local water supply is chlorinated, be sure to use a chlorine-removal agent or let the water stand for 24 hours before adding fish. If equipment must be washed, avoid using soap and rinse everything thoroughly.

Oxygen

Since fish require an adequate oxygen supply, it is very important to provide enough water to hold the oxygen. An easy rule of thumb is one inch of fish to one gallon of water. For example, if you have two small fish whose total length end for end is one inch, you will need one gallon of water. If you have one fish that is two inches long, you will need two gallons, and for a three-inch fish, three gallons, and so forth. The

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carrying capacity of an aquarium can be increased if an aeration system or water plants are added. The use of both is recommended.

Aeration System
One kind of aeration system that is easy to use consists of an air stone connected by tubing to an air pump. The air stone should produce very small bubbles. Smaller bubbles allow more air to be dissolved in the water.

Algae
When algae begin to grow on the sides of the tank add a snail or two to eat the algae. If the growth is too great for the snails, use a plastic scrubber to remove the algae. Be sure to check the filter system for cleaning once the water is clear again.

Temperature
Most aquarium fish will not tolerate wide ranges of temperature. Goldfish and guppies are the exception. Goldfish tolerate temperatures between 40°F and 75°F, and guppies will tolerate ranges from 60°F to 80°F. Freshwater tropicals other than guppies require temperatures from 72°F to 80°F. For tropicals a thermostatically controlled heater and a thermometer are required where the classroom temperature falls below 70°F. Most fish do best if the water temperature is kept between 70°F and 80°F.

Light
Fish and plants need light. Natural lighting is preferable. If the aquarium cannot be located near a window, it may be necessary to use a hood with a fluorescent or incandescent light. Caution is necessary when using incandescent lighting in order to prevent the water from becoming too hot.

Filtration
A filtration system is necessary in a long-term aquarium. Two types are commonly used. One type is placed under the gravel on the floor of the aquarium, allowing the gravel to act as a filter. Plants use the nutrients trapped in the gravel. Some under-gravel systems also use a charcoal filter on the exhaust tube. Once established, the under-gravel system is fairly maintenance-free. The second type filters the water through charcoal and polyester floss to remove the impurities. These filters come in a wide variety of styles. Some are mounted on the outside of the tank and others on the inside. The floss and charcoal must be changed periodically, depending on the size of the filter and the population of the aquarium. See the package instructions for specific recommendations. Both types of filters require an air pump in order to operate. A valve to divide the air from the pump between the aeration and filtration systems is usually needed.

Types of Fish
Which type of fish to choose is a difficult decision. Some of the most hardy are guppies and goldfish. See comments on temperature tolerance above. Your local pet store can help you here. Be sure to insist on healthy specimens. You may also want a variety of live-bearers (guppies, swordtails) and egg layers (goldfish, catfish).

Food
Most aquarium fish do well on a good-quality flake food. Overfeeding is a greater problem than underfeeding. Feed once a day only what is consumed in ten minutes. For weekends, feed the fish Friday before you leave, and they will be fine until Monday morning.

Disease
Disease and death are a part of the aquarium experience. Ich is probably the most common disease. It is caused by tiny animal parasites that produce white spots on the fish. Disease-specific chemicals can be obtained from a pet store and added to the water to kill the parasites or whatever is causing the disease. See the package instructions for specific recommendations. An alternate method that works fairly well for a number of problems is to give the infected fish a saltwater bath. Start with 1 Tbs. of salt/1 gallon of water. Add 1 Tbs. of salt several hours later. Continue at the intervals until the ration reaches 5 Tbs./1 gallon of water. Leave the fish in the bath until symptoms disappear (several days). Then gradually dilute the saltwater bath by removing 1/4 of the salt water and adding fresh water 3 times at 2-3 hour intervals and then return the fish to the original aquarium.

Death
Death frequently occurs in the aquarium. Use it as an opportunity to discuss the life-and-death cycle of living things.

STUDENT ROLE

Ichthyologist

MATERIALS

gallon jars, fishbowls, or aquariums
elodea or other water plants
rocks (optional)
air stones
air pump
valve
tubing

fish
snails
coarse sand or gravel
strainer
filter, floss, charcoal, or underwater filter system
heater (depending on the climate)
aquarium thermometer
magnifying lenses
Student Page 2.3.1 AQUARIUM OBSERVATIONS

PRODUCTS

Healthy aquariums
Completed Student Pages

PROCEDURES

1. **If more than one aquarium is to be used, work with a small group of students to help them become experts on assembling the aquariums. Have them practice before they work with their classmates.**

   There should be
   - An expert on giving directions.
   - An expert on demonstrating procedures.
   - An expert on checking whether tanks are properly assembled, operated, and maintained.

2. **Introduce the aquarium project.**

   Ask such questions as these:
   - What materials are needed to assemble an aquarium?
   - What are some of the needs of the fish?
   - How can you take care of these needs?
   - Why should the aquarium be clean?
   - Why are plants and animals added to the aquarium one kind at a time instead of all at once?

3. **Have the students assemble the aquariums. Have them work under the direction of the student experts.**

   Have the students
   - Clean all equipment.
     ✔ No soap should be used and everything should be rinsed thoroughly.
   - Rinse gravel or coarse sand using a strainer.
   - Install a filter system and gravel.
   - Install an aeration system.
   - Add water.
     ✔ A saucer should be placed on top of the gravel and water poured onto it to avoid disturbing the gravel.
   - Install a thermometer and a heater if needed.

4. **Have the students work under the direction of the experts to aerate and age the water and stabilize the temperature. This will take several days.**

5. **Have the students add water plants under the direction of the experts.**

   Have them
   - Use clean rocks to anchor plants if they wish.
   - Place some aquariums in lighted areas and some in dark areas. If only one large aquarium was assembled, keep it in the sunlight or provide artificial light.
   - Put a water plant or two in a small tank or gallon jar and place in a dark area for this experiment.
   - Observe for a week or more.

6. **Discuss what happens to the plants in the dark and light.**

   Ask such questions as these:
   - Was there a difference in the way that the plants in the light and those in the dark responded?
   - What might account for this?

- Return all aquariums to lighted areas.

7. **Have the students add fish to the aquariums under the direction of the experts.**

   Have them
   - Be sure they equalize the water temperature of the bag holding the fish with the water temperature in the aquarium before releasing the fish into the tank.
     ✔ The bag of water containing the fish should be floated in the aquarium for about 30 minutes before the fish are released.

8. **Review the requirements for maintaining aquariums and add new jobs to the Responsibility Chart.**

9. **Discuss observations of the aquarium. Establish an observation chart and procedures for recording data. Use Student Page 2.3.1 AQUARIUM OBSERVATIONS.**

   Some suggested questions that can be answered by observation are
   - What do fish do when they are first placed in the aquariums?
   - What body parts do fish use as they do different things?
   - How do fish move when they go slowly through the water?
   - How do fish move when they speed through the water?
   - How do fish eat?
   - How do fish defecate?

10. **Have the students investigate the algae when it begins to grow on the aquarium wall.**

    Help them
    - Look for a green film on the glass surface. Observe it with a magnifier. Have them record data on the observation chart.
    - Have the students add snails to their aquariums under the direction of the experts.

11. **Discuss the interaction of algae, snails, and fish.**

    Some suggested questions that can be answered by observation are
    - What does algae look like before the snails are added?

- What does algae look like after snails are added?
- What do the snails do?
- Do the snails and the fish interact? If so, how?
- Do the snails and the algae interact? If so, how?

12. Have the students maintain the organisms and aquariums.

EXTENSION

- If streams are near by, suggest that students bring in small fish and put them in separate tanks.

2.3.2 EXTERNAL ANATOMY OF FISH

OBJECTIVES

The students
- Review their concept of animal anatomy.
- Observe fish and identify anatomical parts and their functions.
- Draw the external parts of a fish.

BACKGROUND

This activity should be done shortly after the fish are introduced into the aquarium. See Activity 2.3.1 THE CLASSROOM AQUARIUM.

Students may identify all or some of the following features of fish external anatomy--the head, eyes, nostrils, mouth, gill coverings, dorsal fin, caudal or tail fin, pectoral fins, ventral or pelvic fins, anal fins, anus, lateral line, scales, spines, barbels, and other features particular to certain species. If transparent fish such as mosquito fish are used, some features of the internal anatomy such as the heart and intestinal tract will also be visible for identification. See Figure 2.3.2.

STUDENT ROLE

Ichthyologist

MATERIALS

aquarium with fish
hand lenses
chart paper
markers
Student Page 2.3.2 FISH ANATOMY

PRODUCTS

Concept map about fish anatomy
Completed Student Pages

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PROCEDURES

1. **Review the concept of animal anatomy and develop a concept map about fish anatomy.**

   Ask such questions as these:
   - What do we mean by the word anatomy?
   - What body parts do you think fish have?
   - What do you think these parts are used for?

2. **Have the students observe a fish to identify the body parts.**

   Ask such questions as these:
   - What do you think external anatomy means?
   - What body parts do you see?
   - How does the fish seem to use these parts?

3. **Have the students draw a fish on Student Page 2.3.2 FISH ANATOMY and help them label the external parts they observe. See Figure 2.3.2.**

4. **Have the students hypothesize possible uses the fish makes of its various body parts.**

5. **Have the students observe the fish over time, watching for behaviors that give evidence for or against their hypotheses.**

6. **Have the students share and discuss their observations after a few weeks. Help them revise hypotheses as needed. Have them make additions and revisions to their concept map.**

EXTENSION

- Bring in other kinds of fish and have the students compare and contrast body parts and functions. Help them make generalizations where possible.

ILLUSTRATION

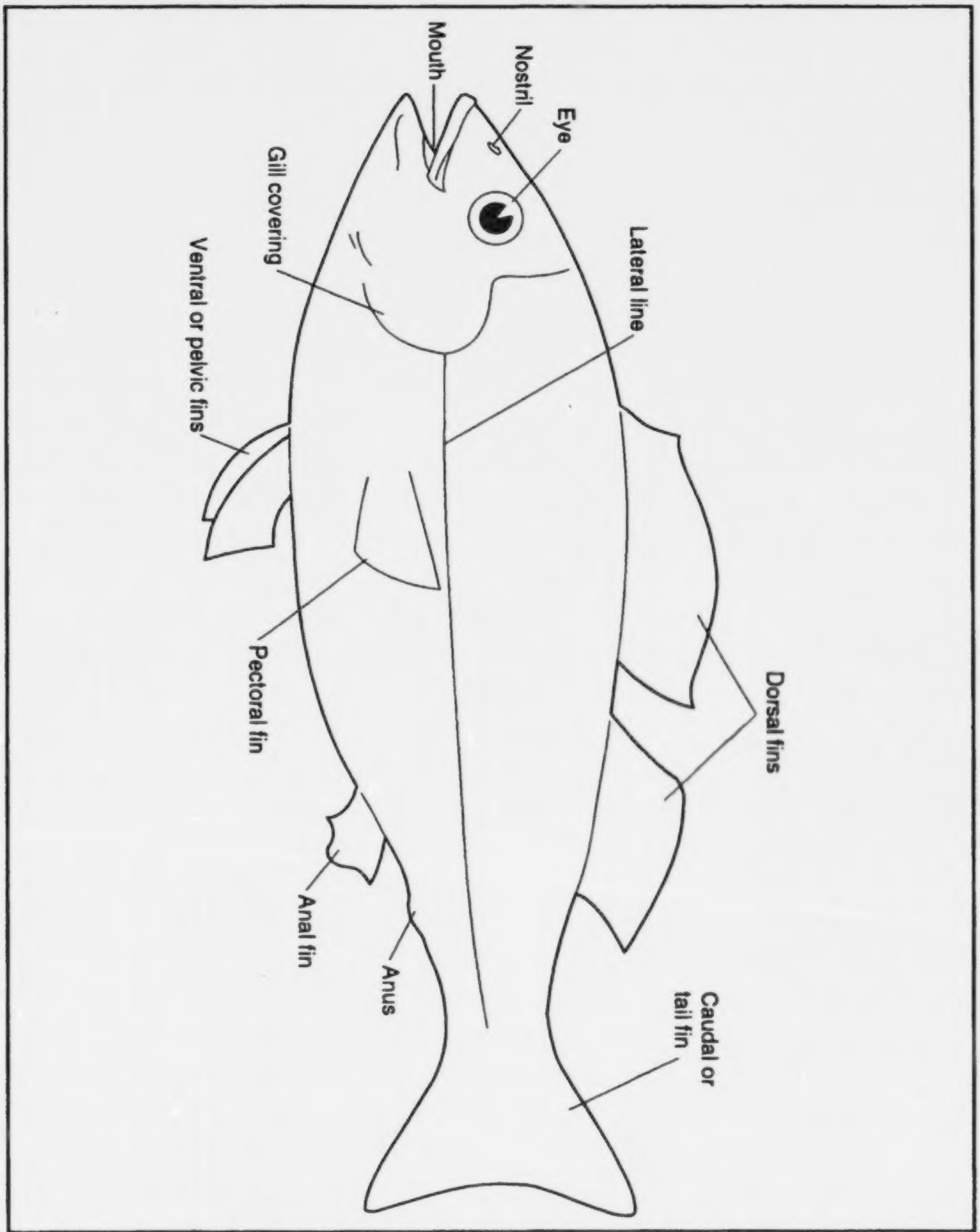
Mouth
Nostril
Eye
Gill covering
Lateral line
Ventral or pelvic fins
Pectoral fin
Dorsal fins
Anal fin
Anus
Caudal or tail fin

Figure 2.3.2 External anatomy of a fish.

2.3.3 BIOLOGICAL NEEDS OF FISH

OBJECTIVES

The students
- Review their concept of biological needs.
- Hypothesize what the biological needs of fish might be.
- Observe fish for evidence of biological needs.
- Summarize their findings.

BACKGROUND

This activity can be undertaken anytime after the aquarium has reached the stage of stabilized maintenance. Students should recall from DASH K and 1 that mammals must have food, air, exercise, and water; that they must eliminate waste, reproduce, and be protected against disease and extremes of temperature. These requirements are identified as biological needs.

STUDENT ROLE

Ichthyologist

MATERIALS

fish in an aquarium
hand lenses
chart paper
markers
Student Page 2.3.3 BIOLOGICAL NEEDS OF FISH

PRODUCTS

Concept map about the biological needs of fish
Completed Student Pages

BEST COPY AVAILABLE

PROCEDURES

1. **Review the meaning of biological needs and develop a class concept map about the biological needs of fish.**

   Ask such questions as these:
   - What do you know about biological needs?
   - What things must mammals have to live?
   - What do you think fish need to live?

2. **Have the students hypothesize what biological needs fish might have and how these needs might be satisfied.**

   Ask such questions as these:
   - What do you think the biological needs of fish are?
   - How could you find out what the biological needs of fish are?

3. **Make a class chart to record evidence of biological needs. Include columns for needs, predicted evidence, and observed evidence.**

4. **Have the students observe fish and their care for evidence of biological needs and how they are satisfied. Record observations on student pages.**

5. **Periodically go over the collected data and have the students add their observations to the class chart. Summarize the activity with the class.**

   Ask such questions as these:
   - Which of our hypotheses seem to be correct?
   - Which of our hypotheses seem to be incorrect?
   - What else might we look for?

EXTENSION

- Have the students hypothesize about the biological needs of snails. Set up observation procedures to find out the biological needs that snails have and how they are satisfied.

2.3.4 REPRODUCTION AND DEVELOPMENT OF FISH

OBJECTIVES

The students
- Review their concept of reproduction.
- Make nets.
- Observe the developing young of fish.
- Record the development of a fish from egg to adult.

BACKGROUND

This activity should be started after the aquarium is stabilized. There are three stages in the development of young fish: 1) the embryo stage in which development is within the egg, 2) the larval stage in which development is outside the egg but adult features are not fully formed, and 3) the fry stage, in which the fish is a miniature adult. Many fish are cannibalistic, so immature young should be separated from adults and placed in a different tank.

STUDENT ROLE

Ichthyologist

MATERIALS

aquarium with stabilized fish population
aquarium to hold larvae and fry
male and female fish
chart paper
hand lenses
aluminum or coat hanger wire for nets
wire cutter
pliers
fine-mesh net or recycled stockings
small saucers
needles and thread
Connections Book
Student Page 2.3.4 FISH DEVELOPMENT

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PRODUCTS

Completed Student Pages

PROCEDURES

1. **Discuss the concept of reproduction with the class.**

   Ask such questions as these:
   - What do you know about reproduction or how animals produce their babies?
   - How do birds reproduce?
   - How do insects reproduce?
   - How do our classroom pets reproduce?
   - How do you think fish reproduce?

2. **Have the students make nets and assemble a tank for holding immature fish.**
   - Introduce the problem of capturing eggs, larvae, and small fish for study.
   - Have the students invent and make nets.
   - Have the students assemble a holding tank for immature fish.

3. **Have the students watch for reproductive behavior of fish in the stabilized aquarium.**

   This may include
   - Nesting
   - Color change
   - Ejection of eggs or live young.

4. **Have the students remove eggs and larvae and put them in the holding tank. This tank should have water taken from the stabilized aquarium.**

5. **Have the students observe the developing fish several times a week until they can see adult characteristics in the young fish.**

   Have them
   - Net the embryos and larvae and use hand lenses to observe them in shallow aquarium water on a small white saucer.
   - Record the development of the fish in drawings on Student Page 2.3.4 FISH DEVELOPMENT.
   - Return the embryos and larvae to the holding tank as soon as possible after the drawings are made.

6. **Have the students summarize the activity by reviewing their drawings of fish development.**

   Ask such questions as these:
   - Can you put your fish drawings in order to show the stages of fish development?
   - What did the fish first look like?
   - What did they look like next?
   - What happened to the size of the developing fish over time?
   - How long did it take the fish to reach the size of their parents?
   - What did the larval fish appear to eat? How could you tell?

7. **Have the students discuss the importance of their study of fish. Record their ideas in the Connections Book.**

   Ask such questions as these:
   - Why is it important to learn about fish?
   - Where else might you use what you have learned about fish?
   - Who else needs to know about fish?

EXTENSIONS

- Have the students try to identify male and female fish and give their reasons.
- Have the students observe the aging process in mature fish.

2.3.5 FINDING INSECT EGGS

OBJECTIVES

The students
- Review their concept of insects.
- Plan an insect egg hunt.
- Explore their environment for places to find insect eggs.

BACKGROUND

In this activity students observe and record where insects lay their eggs. They make a preliminary investigation to discover what they will need to care for the eggs properly when they are collected.

Insect body parts

Insects are related to crabs and shrimp. The students were introduced to insects in DASH K and continued study in DASH 1. Now they are asked to recall that insects have a hard external skeleton called an exoskeleton and that their bodies have three parts—a head, thorax, and abdomen; that they have three pairs of legs and often two pairs of wings attached to the thorax and that they have one pair of antennae.

Finding Eggs

Some of the best places to look for insect eggs are on the underside of leaves, under rocks, in rotting logs and other protected places. Many insects lay their eggs in protective egg cases. Butterfly and moth eggs are usually laid on the plant on which the larvae will feed. Ants and grasshoppers lay their eggs in the ground. Mosquitoes lay their eggs in standing water. Late summer and early fall are good times to look for many types of insect eggs although they can be found at almost any time of the year.

STUDENT ROLE

Entomologist

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MATERIALS

chart paper
hand lenses
Student Page 2.3.5 INSECT EGGS

PRODUCTS

Concept map about insects
Completed Student Pages

PROCEDURES

1. **Review the concept of insect and have the students develop a class concept map about insects.**

   Ask such questions as these:
   - What are insects?
   - What do you know about insects?
   - What are insects like?
   - What are the body parts of insects?
   - What do insects do?
   - How do insects reproduce?
     ✔ Work toward the idea of laying eggs.

2. **Introduce and discuss the problem of finding eggs with the class.**

   Ask such questions as these:
   - When did you find insects last year?
   - Can anyone remember what insect eggs look like?
   - Where did you find insects last year?
   - Where do you think you could find insect eggs this year?
   - How might you collect insect eggs?

3. **Have the students prepare for an insect egg hunt. Establish that the purpose of this first egg hunt is to find out where different insects lay their eggs, not to collect them.**

   Ask such questions as these:
   - If you find eggs, how could you find out which insects laid them?
     ✔ Work toward the idea of hatching the eggs to see what emerges.

   - How could you take care of the eggs?
     ✔ Work toward the idea of keeping some of the environment where the eggs were found.

4. **Have the students plan for an insect egg hunt.**

   Help them to include such things as these
   - Where they will look for eggs.

   - How they will decide on what they would need to bring back with the eggs if they were going to raise them.

5. **Have the students go on a preliminary observation hunt to find out where insect eggs are found.**

6. **Have the students describe the eggs and the environment in which they were found on Student Page 2.3.5 INSECT EGGS.**

   Ask such questions as these:
   - Where did you find insect eggs?

   - What will you need for the eggs to grow?

   - How many different kinds of eggs did you find?

2.3.6 HATCHING INSECT EGGS

OBJECTIVES

The students
- Make insect cages.
- Observe the changes in insect eggs.
- Observe the emergence of the larvae or nymphs from the eggs.

BACKGROUND

HATCHING INSECT EGGS follows 2.3.5 FINDING INSECT EGGS and is accompanied or preceded by Activity 2.3.14 PET CARE. It is followed by 2.3.7 EARLY METAMORPHOSIS.

Here we are concerned with the egg and larval stages of development. The students build insect cages and prepare environments to hatch the eggs found in Activity 2.3.5 FINDING INSECT EGGS. The cage environment should mimic the natural environment as closely as possible.

Using the knowledge of where eggs can be found, the students collect and observe them, watching for larvae and nymphs to appear. Insects have various developmental patterns. Some emerge looking like tiny adults. These are called *nymphs*. The nymphs grow and molt (shed their skin), develop wings, and after several sheddings become adults. Grasshoppers develop in this way. This is called *incomplete metamorphosis*.

Other insects develop through four stages or *complete metamorphosis*. These insects, such as most butterflies and moths, begin as eggs. The next stage is the larval or caterpillar stage. Then comes the *pupa* or *resting stage* when the caterpillar spins a chrysalis or cocoon from which the adult butterfly or moth emerges.

STUDENT ROLE

Entomologist

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MATERIALS

information about egg sites from Activity 2.3.5 FINDING INSECT EGGS
pint and half-pint milk cartons
plastic wrap or laminating film scraps
scissors
tape
clothespins
old nylon stockings, open-weave cloth scraps, fine mesh screen
clear plastic cups and other recycled containers
Student Page 2.3.6 HATCHING INSECT EGGS

PRODUCTS

Insect cages
Insects in the larva or nymph developmental stage
Collection of insect eggs
Completed Student Pages

PROCEDURES

1. **Have the students work in groups to make insect cages using materials from the Inventor's Box.**

   Help them
   - Recall that insect cages were made in DASH 1.
   - Recall the needs of animals for air, food, and water,
   - By providing suggestions for cages if necessary.
     ✔ Ask questions to help students recognize the need for improvements.

2. **Discuss the maintenance of the insect eggs in cages.**

   Ask such questions as these:
   - Why would you want to keep some part of the original environment with the egg?
   - Where should you keep the eggs?
   - When do you think the eggs will hatch?

3. **Have the students go out and collect insect eggs previously found in Activity 2.3.5. FINDING INSECT EGGS. Have them prepare the hatching environment and then put the eggs into their insect cages.**

4. **Have the students observe and record the changes in the eggs on Student Page 2.3.6 HATCHING INSECT EGGS.**

   Have them
   - Set times for daily observations.
   - Observe the eggs daily and record the data.
   - Share the emergence of the insects with the class.

5. **Discuss the changes in the insect eggs with the class.**

   Ask such questions as these:
   - Where was your egg found?
   - What kind of organism emerged from the egg?
   - What kind of food do you think it eats?
   - What kind of food was near it?

EXTENSION

- On each insect cage help the students write what kind of insect they think will emerge.

DASH 2.3.7 EARLY METAMORPHOSIS

OBJECTIVES

The students

- Hypothesize about what to feed the insect larvae or nymphs.
- Feed and care for insects.
- Observe the formation of pupae or larger nymphs.

BACKGROUND

This activity continues the observations begun in Activity 2.3.6 HATCHING INSECT EGGS. Students observe the development of their larvae or nymphs. They determine what to feed them. This is often indicated by the environment from which the eggs were collected.

The object is to observe what the insects develop into in the next stage. If the insect is in a larval stage, it will change to the resting stage or to a *pupa* which will be some form of *cocoon* in the case of a moth or a *chrysalis* in the case of a butterfly. If the insect went from egg to nymph, it should molt and emerge as a larger nymph. At one of these numerous moltings wings will often appear.

STUDENT ROLE

Entomologist

MATERIALS

larvae or nymphs in cage
food as needed
Student Page 2.3.7 EARLY METAMORPHOSIS

PRODUCTS

Pupae or larger nymphs
Completed Student Pages

BEST COPY AVAILABLE

PROCEDURES

1. **Have the students hypothesize what will happen next in their insects' development.**

2. **Help the students hypothesize what to feed the larvae or nymphs. Have the students look for similar insects in places like those where they found their eggs. See what these insects are eating.**

3. **Have the students feed and care for their insects.**

   Have them
   - Gather food and feed the insects.
   - Check to see that the insects are eating what they are given.
   - Look for other food if the insects reject their first offerings.

4. **Have the students observe and record what happens to their insects on Student Page 2.3.7 EARLY METAMORPHOSIS. Share any dramatic change, with the class.**

5. **Have the students discuss and summarize their observations.**

   Ask such questions as these:
   - What happened to the larva or nymph?
   - What do you think will occur next?

EXTENSION

- Have the students keep their records in folders next to their insect cage so that their observations can be shared with others.

2.3.8 LATE METAMORPHOSIS

OBJECTIVES

The students
- Care for insect pupae or nymphs.
- Observe the formation of adult insects.

BACKGROUND

LATE METAMORPHOSIS follows Activity 2.3.7 EARLY METAMORPHOSIS and is the last activity in the insect series.

The students continue to watch the metamorphosis of their insects. If their insect has turned into a pupa (cocoon or chrysalis), it will not require any food. If it is a nymph, it will still need food as it continues to molt. The final developmental stage regardless of the type of metamorphosis is the adult stage. If their insects seem to be languishing have the students release them. All insects should be released as soon as observations of the adult stage are completed.

STUDENT ROLE

Entomologist

MATERIALS

pupae or nymphs in cage
insect food as needed
Concept map about insects
Working Dictionary
Connections Book
Student Page 2.3.8 LATE METAMORPHOSIS

PRODUCTS

Adult insects
Revised working definition of insects
Completed Student Pages

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PROCEDURES

1. **Have the students continue to hypothesize about what to feed their metamorphosing insects.**

   Help them
   - Look for similar insect stages in places like those where they found their eggs.
   - See what such organisms are eating.

2. **Have the students feed and care for their insects.**

3. **Have the students observe what happens to their insects. Have them record on Student Page 2.3.8 LATE METAMORPHOSIS. Share any dramatic changes with the class.**

4. **Have the students summarize and discuss their insects' metamorphoses.**

   Ask such questions as these:
   - What emerged from the pupa or late nymph stage?
   - What kind of food would you want to feed the new organisms if they appear to need food?
   - What do you think will occur next?
   - What has happened to your insects since they were eggs?
   - Have all the insects developed through the same stages? How have they been alike? Different?

5. **Have the students release their adult insects back into the environment where they found their eggs.**

6. **Have the students add and revise information on their concept maps about insects.**

   Have them
   - Use the concept map to revise their grade 1 working definition of insects and record it in the Working Dictionary.

- Discuss the importance of studying insects and record their ideas in the Connections Book.

EXTENSION

- Have the students make bulletin board displays, posters, or models showing the stages of metamorphosis of their insects.

2.3.9 COLLECTING SPIDERS

OBJECTIVES

The students
- Make a concept map about spiders.
- Observe spiders in the wild.
- Capture spiders and make detailed observations before returning them to where they were found.

BACKGROUND

COLLECTING SPIDERS should follow Activity 2.3.14 PET CARE and is followed by 2.3.10 SPIDER FOOD, 2.3.11 SPIDER CARE, 2.3.12 SPIDERS AS PREDATORS, and 2.3.13 SPIDER WEBS. In COLLECTING SPIDERS the students make temporary spider cages and capture spiders, observe them, and return them to their original habitat.

Spider Body Structure

Spiders are members of the phylum Arthropod, which contains animals with hard outer skeletons and jointed legs. Spiders are of the class Arachnid. They have four pairs of legs, no wings or antennae, two body regions—the cephalothorax (a combined head and thorax) and an abdomen. Most spiders have eight eyes. They grow by molting or shedding their exoskeleton.

Kinds of Spiders

There are over 30,000 kinds of spiders. They can be generally divided into the ground spiders such as wolf spiders and web spiders such as the daddy-long-legs.

Spider Habitats

Spiders are found in the attics and basements of houses, gardens, fields, woods, under stones or logs, and in the bark of trees. Some spiders are found in burrows in the ground.

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Spider Food
Spiders eat insects. The kinds of insects that they eat can be determined by looking at the exoskeletons or other body parts found in their webs and around their burrows. See Activity 2.3.10 SPIDER FOOD.

Spider Cages
The students can make good observation cages from clear plastic cups with nylon hose stretched over the tops and secured with rubber bands. They can also make good cages from half-pint milk cartons with a window cut in one side and covered with clear plastic wrap for observation. Be sure they provide for air.

Collecting Spiders
Spiders can be collected by sweeping shrubs and tall weeds with nets. Some can be shaken out of leaf litter into a collecting cage. Night is a good time to use a flashlight to look for wolf spiders and small web spiders. In places where winters are cold, it is best to save spider hunting for the spring, though some spiders can be found in warm buildings.

Handling Spiders
Normally spiders **should not be caught or touched with bare hands.** Although they are not usually aggressive, they can bite. Plastic gloves will protect against bites. There are few spiders that are poisonous to humans. In the United States the dangerous spiders are the brown recluse and black widows. These are both web spiders. The black widow spins its web in the open. The brown recluse spins it web under cover, often under furniture or other secluded places in houses. Both spiders prefer warmer climates. Because there is no specific first aid for a spider bite, it is best to consult a doctor in the case of bites. Bites from both spiders can be quite dangerous.

Resources
This is a good time to have the students do research to get more information on their spider. The Golden Guide series and Peterson Field Guide series will give them a good start.

STUDENT ROLE

Arachnologist

MATERIALS

plastic gloves
hand lenses

chart paper
pint and half-pint milk cartons
plastic wrap
rubber bands
scissors
tape
clear plastic cups
nylon stockings
sticks and flags for location markers
books on spiders, see the *DASH* Book List
Student Page 2.3.9 SPIDER HUNT

PRODUCTS

Concept map about spiders
Spider cages
Location markers
Completed Student Pages

PROCEDURES

1. **Determine the students' understanding of spiders by helping them develop a class concept map about spiders.**

   Ask such questions as
   - What are spiders?
   - What do you know about spiders?
   - What do spiders look like?
   - What do spiders do?

2. **Discuss the problem of finding spiders.**

   Ask such questions as
   - Where have you seen spiders?
   - What time of year have you seen spiders?
   - What do you think spiders eat?
   - How could you tell what spiders eat?

- How could you get spiders to come out so you can see them?
  ✔ Get at such things as waiting and watching and gently but rapidly shaking a web as an insect might.

- How could you safely capture a spider?

- How could you capture the spiders without touching them?
  ✔ Get at the idea of using plastic gloves or shaking them into a container.

3. **Help the students prepare for a spider hunt. Point out that it would be interesting to find out how insects and spiders live together.**

   Ask such questions as
   - What do you need to observe spiders?

   - How can you record what you see?

   - Are there spiders you should be careful of?
     ✔ Go over precautions about handling spiders such as wearing plastic gloves and being very gentle with them.

4. **Have the students work in groups to make spider cages using materials from the Inventor's Box. Have them invent ways to mark the place where they find their spiders.**

   Have them
   - Display their cages and markers and discuss any possible problems.

   - Modify their cages and markers as needed.

5. **Have the class go on a spider hunt and record what they observe on Student Page 2.3.9 SPIDER HUNT.**

   Have them
   - Record where they find their spider and place a location marker.

   - Record what the spider's home is like.

   - Record evidence of the spider's eating habits.

   - Capture the spider.

6. Discuss the spider hunt with the students.

Ask such questions as
- What spiders did you find?
  ✔ Have reference books available.
- Where did you find your spiders?
- How many people found the same kind of spiders in a place like that?
- How many kinds of spiders did you find?

7. Have the students complete the activity.

Help them
- Draw and label the parts of their spiders.
- Complete Student Page 2.3.9 SPIDER HUNT.
- Return the spiders to their homes.
- Add to the concept map about spiders.

EXTENSION

- Have the students make a *Believe It or Not* book of spiders, describing unusual ones such as the world's biggest, smallest, fattest, and so forth.

2.3.10 SPIDER FOOD

OBJECTIVES

The students
- Discover what spiders eat.
- Observe spiders eating in the field.

BACKGROUND

Spiders primarily eat insects. Observing a web spider consume its prey can be a fascinating experience. This project requires considerable patience. The spider will usually cease its eating if disturbed. Students need to be reminded to move slowly and quietly. Ground spiders are more difficult to observe because they are more easily frightened and usually run away. This can be an excellent home assignment with parental assistance.

STUDENT ROLE

Arachnologist

MATERIALS

hand lenses
Student Page 2.3.10 SPIDER FOOD

PRODUCTS

Completed Student Pages

PROCEDURES

1. **Discuss what spiders might eat.**

   Ask such questions as these:
   - What do you think spiders eat?

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- What evidence do you have for your ideas?
- Do you think all spiders eat the same things?
- How could you find out what spiders eat?

2. **Have the students observe spiders eating in the field.**

Have them
- Observe spiders eating when they are not disturbed.
- Observe what is in their webs.
- Observe body parts left behind after eating.
- Share their observations with the class.
- Record their observations on Student Page 2.3.10 SPIDER FOOD.

EXTENSION

- Have the students explore the question, *Do spiders clean their webs of the body parts of animals they have eaten?*

2.3.11 SPIDER CARE

OBJECTIVES

The students
- Capture a spider.
- Construct a long-term cage.
- Care for and feed a spider.

BACKGROUND

In this activity, the students attempt long-term care of spiders. Glass gallon jars make excellent observation cages. Web spiders can be kept in jars if the opening is covered with a piece of fine mesh such as a recycled stocking. Ground spiders can be kept in a terrarium that has soil. The terrarium may be a glass gallon jar. Be sure air can enter the cage and that it is not in the direct sunlight.

Spider Food

Spiders should be kept singly to prevent their *snacking* on each other. They will usually eat flies, mealworms, and cockroaches. Most spiders can go for several days without eating. If a spider does not eat for more than three or four days it is best to return it to its original environment. Spiders do need some water, but don't allow the cage to get moldy.

STUDENT ROLE

Arachnologist

MATERIALS

concept map about spiders
pint and half-pint milk cartons and other plastic containers
plastic wrap, cloth, and other cage-making materials
glass or clear plastic gallon jars with lids
sticks and paper flags for location markers
terrarium materials for ground spiders
Wonder and Discover Book
Student Page 2.3.11 CARING FOR SPIDERS

BEST COPY AVAILABLE

PRODUCTS

Completed Student Pages

PROCEDURES

1. **Have the students capture spiders and make long-term cages.**

Have them
- Decide which type of container is needed based on the kind of spider they intend to capture—web or ground.
- Make cages for long-term care.
- Plan for providing food and water for their spiders.
- Capture a spider and place it in the cage.
✔ Remember safety precautions in handling spiders.

2. **Have the students care for and feed their spiders.**

Have them
- Capture food for their spider.
- Observe how the spider prepares and then eats its meal.
- Observe what the spider does after it has eaten.
- Share their observations with other students.
- Record care and observations on Student Page 2.3.11 CARING FOR SPIDERS.
- Ask and answer questions of special interest to them.
✔ Record these in the Wonder and Discover Book.

3. **Discuss and summarize student observations.**

Ask such questions as these:
- What does your spider eat?
- Do spiders eat more than one thing?
- Do different kinds of spiders eat different things?

- What should you do if your spider doesn't eat?
- What else did you find out about spiders?

4. **Have the students add new information to the concept map about spiders.**

EXTENSION

- Have the students make a spider island by putting a small tree branch in soil in a can. Place the can in a larger pan so that the can is surrounded by water. The spider will be isolated on the island. Keep out of drafts or the spider will *fly away* on a web filament.

2.3.12 SPIDERS AS PREDATORS

OBJECTIVES

The students
- Observe spiders spinning their webs.
- Observe spiders capturing food.
- Research the ways different spiders capture their food.

BACKGROUND

In this activity students observe spiders building and using their webs. Since most web building occurs at night this is a good home activity. Students should be warned not to disturb the spiders or they are likely to cease their activity.

Making a Web

If the spiders have been housed as described in activity 2.3.11 SPIDER CARE, they can be easily observed in the classroom when they are active. Most orb webs begin with a bridge between two objects. The spider usually lets the wind pull the thread for the initial connection. The next step is for the spider to drop a thread from the center of the bridge, retrace its path back to the center, and then move over to the other side and attach the strand. The center of this strand becomes the hub from which radii are constructed. Then the spider spins a temporary spiral that it retraces in reverse to lay down the permanent, more closely spaced spiral. Repairs and strengthening of the web are done as needed. There are many variations to this procedure, depending on the species of spider observed.

Using the Web

It is in the use of the web as a sticky trap to capture other insects that the predatory side of the spider emerges. The spider kills trapped insects and secures them for eating.

STUDENT ROLE

Arachnologist

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MATERIALS

hand lenses
spider in a cage
Student Page 2.3.12 HOW SPIDERS CAPTURE FOOD

PRODUCTS

Completed Student Pages

PROCEDURES

1. **Discuss with the class how spiders might capture food.**

   Ask such questions as these:
   - How do you think spiders capture food?
   - What evidence do you have for your ideas?
   - Do you think all spiders capture food the same way?
   - How could you find out how spiders capture food?

2. **Have the students observe spiders eating in the field.**

   Have them
   - Observe spiders spinning webs.
   - Observe spiders using their webs.
   - Record observations on Student Page 2.3.12 HOW SPIDERS CAPTURE FOOD.

3. **Have the students observe spiders spinning and using their webs in the classroom.**

   Have them
   - Share their observations with other students when they find spiders spinning or using their webs.

2.3.13 SPIDER WEBS

OBJECTIVE

The students
- Invent ways to measure the strength of spider webs.

BACKGROUND

In this open-ended activity students invent a way to measure the strength of spider webs. Some possible methods might include such things as finding out how far webs can be stretched, how much weight they can hold before they break, and other ideas the students invent. Weights could be paper clips. The Inventor's Box can be used to stimulate ideas if necessary. Stock the Inventor's Box with string, thread, rulers, weights of different kinds, and anything else that comes to mind or students suggest.

STUDENT ROLE

Arachnologist

MATERIALS

balance from Activity 2.10.3 THE BALANCE
equipment as specified by groups
Student Page 2.3.13 SPIDER WEBS

PRODUCTS

Completed Student Pages

PROCEDURES

1. **Discuss with the students how strong spider webs are and how they might be used to capture food.**

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Ask such questions as these:

- What holds an insect in a web?
- Did anyone see an insect break a spider's web?
- How strong is a spider's web?
  ✓ Paper clips attached to a single strand could be used.
- Do you think all spider's webs are equally strong?
- Do you think all the filaments in a web are equally strong?
- How could you find out how strong a spider's web is? How could you measure this?
  ✓ This is an opportunity for students to use the balances made in Activity 2.10.3 THE BALANCE.

2. **Have student groups invent ways to measure the strength of spider webs and find out what holds insects in them.**

3. **Have the students carry out their experiments and record their data on Student Page 2.3.13 SPIDER WEBS.**

4. **Have the students report on the results of their experiments.**

EXTENSIONS

- Make a spider web print. Lightly spray a web with light colored paint, then lay a piece of black construction paper against it.
- Compare the strength of orb webs, funnel webs, cobwebs, and so forth.

2.3.14 CLASSROOM PETS

OBJECTIVES

The students
- Review the needs of classroom pets.
- Take responsibility for the care of classroom pets.
- Revise their Working Definition of pets.

BACKGROUND

An important component of the DASH program is the care of classroom pets. The students learn to take care of pets beginning in kindergarten. In DASH 2, they investigate and care for fish, insects, and spiders.

This activity provides general suggestions for any class pets either those under study or turtles, birds, rabbits, and so forth. What is important is to establish the routines of care required to meet each pet's needs.

STUDENT ROLE

Animal caretaker

MATERIALS

chart paper
markers
animals
cages
food
water
newspaper or litter
Working Dictionary
Responsibility chart
Student Page 2.3.14 PET CARE

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PRODUCTS

Well-cared-for pets
Class charts on pet care
Revised working definition of pets
Completed Student Pages

PROCEDURES

1. **Introduce any classroom pets to the students. Demonstrate their proper handling and care.**

   Have them discuss
   - How to handle the pet.
   - Food and water requirements.
   - Cage making and maintenance. See activities on specific animals studied in DASH 2.
   - Other needs of the particular pet.

2. **Have the students complete Student Page 2.3.14 PET CARE, make a chart on the pet's care, and post it near the pet's cage.**

3. **Have the students add pet care jobs to their Responsibility Chart.**

4. **Have the class revise their first grade working definition of pets and record it in their Working Dictionary.**

EXTENSION

- Have the students keep a journal about their class pets or write stories about what it is like to be a pet in the classroom.

DASH

AQUARIUM OBSERVATIONS
SP 2.3.1

Name: ______________________

Date: ______________________

DATE	OBSERVATIONS

DASH

FISH
ANATOMY
SP 2.3.2

Name: ______________________

Date: ______________________

Draw a fish and label its parts.

BIOLOGICAL NEEDS OF FISH SP 2.3.3

Name: ____________________

Date: ____________________

DATE	NEED	OBSERVED EVIDENCE

DASH

FISH DEVELOPMENT SP 2.3.4

Name: ______________________

Date: ______________________

Draw pictures of the baby fish as they grow and develop.	
DATE: ______________	DATE: ______________
DATE: ______________	DATE: ______________
DATE: ______________	DATE: ______________
DATE: ______________	DATE: ______________

DASH

INSECT EGGS
SP 2.3.5

Name: ____________________

Date: ____________________

DESCRIBE THE INSECT EGG'S ENVIRONMENT	
WHERE DID YOU FIND THE EGGS?	
PREDICT WHAT KIND OF INSECT WILL HATCH	
PICTURE OF EGGS FOUND	

DASH

HATCHING INSECT EGGS
SP 2.3.6

Name: ______________________

Date: ______________________

WHERE FOUND: ______________________

PREDICTIONS: ______________________

DATE	OBSERVATIONS

DASH

EARLY METAMORPHOSIS
SP 2.3.7

Name: ______________________

Date: ______________________

DATE	CARE AND OBSERVATIONS

DASH

LATE METAMORPHOSIS
SP 2.3.8

Name: ____________________

Date: ____________________

DATE	CARE AND OBSERVATIONS

DASH

SPIDER HUNT
SP 2.3.9

Name: ____________________

Date: ____________________

Draw a picture of your spider.
Where did you find your spider?
What was your spider's home like?
What does your spider eat?
Other observations:

DASH

SPIDER FOOD
SP 2.3.10

Name: ______________________

Date: ______________________

DRAW OR TELL WHAT THE SPIDER LOOKED LIKE.	WHAT DID IT EAT?	OTHER OBSERVATIONS

DASH

CARING FOR SPIDERS
SP 2.3.11

Name: ____________________

Date: ____________________

Draw and label a picture of your spider and its cage.

DATE	CARE AND OBSERVATIONS

DASH

HOW SPIDERS CAPTURE FOOD
SP 2.3.12

Name: ______________________________

Date: ______________________________

Tell how the spider spun its web.	Draw a picture of the web.

Tell how the spider used its web.

DASH

SPIDER WEBS
SP 2.3.13

Name: ______________________

Date: ______________________

Draw or tell how you will find out how strong a spider's web is.

WHICH KIN OF WEB	WHOLE-WEB STRENGTH	SINGLE-THREAD STRENGTH

DASH

PET
CARE
SP 2.3.14

Name: ______________________

Date: ______________________

Name of Pet:	Kind of Animal:	
Age:	Sex:	Color:

Draw a picture of the class pet.

List of Pet's Needs

DASH

GRADE 2
CLUSTER 4

Plants

2.4.1 Soil
2.4.2 Making Soil
2.4.3 Soil and Plants
2.4.4 Soil Uses
2.4.5 Finding Soil
2.4.6 Pipes and Water
2.4.7 Moving Water
2.4.8 Moving Water with Pumps
2.4.9 Vegetable Garden in a Bucket
2.4.10 Flower Garden in a Bucket
2.4.11 Plants and Sunlight
2.4.12 Rooting Stems
2.4.13 Rooting Bulbs and Tubers
2.4.14 Roots And Water
2.4.15 Growing Root Vegetables
2.4.16 Tree Planting

GRADE 2
ACTIVITY GOALS

CLUSTER 4
Plants

2.4.1 Soil

To investigate different soils; to observe components of soil; to invent a way to sort soil components by size; to measure the volume and mass of different, sizes of soil particles; to develop fine motor, observation, measuring, problem solving, and recording skills.

2.4.2 Making Soil

To make soil modeled after natural soil; to hypothesize about the formation of natural soil; to develop fine motor, measuring, problem solving, and recording skills.

2.4.3 Soil And Plants

To test the relative capacity of student-made and natural soils to support plant growth; to plan a comparative experiment; to interpret results; to develop fine motor, observation, problem solving, and recording skills.

2.4.4 Soil Uses

To survey the ways soils are used; to develop a working definition of soil; and to develop observation and reasoning skills.

2.4.5 Finding Soil

To make a survey of where soil is found; to plan and carry out experiments as to what constitutes soil; and to develop fine motor, observation, problem solving, and recording skills.

2.4.6 Pipes And Water

To make a survey of the school water system; to create a diagram of the school water system; and to develop observation, reasoning, and recording skills.

2.4.7 Moving Water

To experiment with controlling water flow through pipes and tubes; to discover how to make a siphon; to discover that for water to flow, the reservoirs must be above the delivery point; and to develop fine motor, observation, problem solving, reasoning, and recording skills.

2.4.8 Moving Water with Pumps

To construct a syringe-type water pump; to experiment with ways to move water with pumps; and to develop fine motor, observation, problem solving and recording skills.

2.4.9 Vegetable Garden in a Bucket

To make a vegetable garden in a bucket; to grow foods for nutritional studies; and to develop fine motor, organization, measuring, and recording skills.

2.4.10 Flower Garden in a Bucket

To make a flower garden in a bucket; and to develop fine motor, observation, organization, and recording skills.

2.4.11 Plants and Sunlight

To discover that plants may grow in the dark; to observe that plants only thrive in light; to plan and carry out an experiment with light-starved plants; and to develop fine motor, observation, problem solving, reasoning, and recording skills.

2.4.12 Rooting Stems

To discover that roots will grow from the stems of plants in water; to experiment with transplanting rooted stems; to modify working definitions of life and plants from DASH 1; and to develop observation, fine motor, reasoning, and recording skills.

2.4.13 Rooting Bulbs and Tubers

To explore different parts of plants for their rooting capacity; to discover the rooting capacity of bulbs and tubers; and to develop observation, fine motor, reasoning, and recording skills.

2.4.14 Roots And Water

To review the structure of seeds and their germination; to experiment with ways to control the direction of root growth; to experiment with the need of roots for water; and to develop observation, fine motor, reasoning, and recording skills.

2.4.15 Growing Root Vegetables

To do a comparative experiment to contrast growth in root vegetables and seed producing vegetables; to develop observation, fine motor, reasoning, and recording skills.

2.4.16 Tree Planting

To begin a three year study of tree growth; to receive an intergenerational gift; to reflect on the reason for long term farming of trees; to reflect on the meaning of a renewable resource; to reflect on the meaning and reason for Arbor Day or Earth Day; and to develop observation, measuring, reasoning, reflecting, and recording skills.

DASH 2.4.1 SOIL

OBJECTIVES

The students
- Collect soil samples.
- Investigate soil with a magnifying glass.
- Invent a method of drying soil.
- Invent a device to sort components by particle size.
- Measure volume and mass of soil components.

BACKGROUND

This activity follows Activities 2.10.3 THE BALANCE and 2.10.5 MEASURING VOLUME.

In SOIL the students begin their investigation of soil. First they devise a way to dry the soil without using a stove. Sun drying is suggested though students may have other ideas. Spreading the soil on a tray and breaking up large pieces will speed the process. The students then separate the soil into its different components by sifting.

Sieves

Sieves with different-sized holes can be made by using various sizes of nails and aluminum pie or cake pans. A hammer may be useful but be sure to protect the surface under the pans. Standardize the sieves by the diameter of the nails used to make the holes.

STUDENT ROLE

Agronomist

MATERIALS

chart paper
soil
half-pint milk cartons for soil samples
trowels (shovels)
magnifying glasses

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aluminum pie or cake pans (4 per group)
aluminum foil
nails (1 set per group)
  three-penny (small)
  eight-penny box nails (medium)
  twelve-penny box nails (large)
hammers (optional)
wood to pound on (if hammers are used
newspaper
balances from Activity 2.10.3 THE BALANCE
graduated containers from Activity 2.10.5 MEASURING VOLUME
goggles
Student Page 2.4.1 SOIL

PRODUCTS

Concept map about soil
Completed Student Pages

PROCEDURES

1. **Help the class make a concept map about soil. Announce that they are going to study soil.**

   Ask such questions as these:
   - What do you know about soil?
   - How is soil used?
   - What do you think soil is made of?
   - Are soil, mud, and sand the same thing?
   - Are soil and dirt the same thing?
     ✔ This question is likely to stir up quite a debate. Encourage the students to research their views. There is not complete agreement in the scientific community so there is no definitive answer to this question—and many others in science. This is the nature of science.

2. **Have the students work in groups and go outside to get two half-pint samples of soil from the same place. Set aside one sample for Activity 2.4.3 SOIL AND PLANTS. Have different groups get samples from various places. Alternately have the students bring the samples from home.**

3. **Have the students investigate the soil samples with magnifying glasses.**

Have them
- Pour one of the two soil samples onto newspaper.
- List the kinds of things they find in the samples.
- Inspect, identify, and then return any living organisms to the places they were found.
- Report findings on Student Page 2.4.1 SOIL.
- Add any new information to the concept map about soil.

4. **Have the students invent a way of drying soil if it is moist. Explain that to study the soil further you must invent a way to dry it. Only natural heat sources are to be used.**

Ask such questions as these:
- How could you dry your sample if you can't use a stove?
- Do you know any natural heat source?
- If you have two samples of soil the same size and roll one into a ball and place it on your hand and spread the other on your hand, which would dry more quickly?
  ✔ Work for the idea that the spread-out soil will dry more quickly. Have someone try it and see,
- What might this tell you about drying soil quickly?
  ✔ Work for the idea of spreading soil thinly to dry it more quickly.
- What happens to the soil when it is dry?
  ✔ Work for the idea that it breaks up into small pieces.

5. **Once the soil is dried have the students study their samples again. Have the students invent ways to granulate chunks of soil and to separate dry soil by particle size.**

Ask such questions as these:
- What different kinds of things did you find?
- Are there chunks of dried soil?

- How could you break these chunks into smaller pieces?
  ✔ Work for such things a rubbing them together, putting them into a sock and hitting the sock against the floor.
- How could you separate all of the particles that are about the same size into different piles?
  ✔ If students don't come up with an idea, show the students a toy sand sifter. Ask how the device works.
- How could you make such a device?
- How can you make holes of different sizes?
- How can you make all the holes in a sieves the same size?
  ✔ Help them *only as needed* to make 3 sieves with different-sized holes. See suggested nail sizes.

6. **Have the students measure out approximately 125 mL or 1/2 cup of dry soil. Use their graduates from Activity 2.10.5 MEASURING VOLUME. Have them sort and measure the mass and volume of soil particles of different sizes.**

Help them
- Weigh their sample before beginning to sift. Record the mass and volume of the soil sample on SP 2.4.1 SOIL.
- Sort the particles by sifting or other methods.
- Weigh the amount of material of each different particle size using their balances. Record their data on Student Page 2.4.1 SOIL.
- Measure the volume of the amount of material of each different particle size using their graduates. Record their data on the Student Page 2.4.1 SOIL.

7. **Help the students make some generalizations about soil.**

Ask such questions as these:
- What does soil seem to be made of?
- Do all samples of soil contain the same things? Explain.
- Are there the same amounts of different-sized particles in various samples of soil?

- Is the sum of the masses of the different sized particles equal to the mass of your starting sample? Volumes? If not, what might have happened?
- What information should be added to or modified on the concept map about soils?

EXTENSIONS

- Set up an agronomist center where students can investigate, measure, and record the contents of additional soil samples they collect.
- Create a bulletin board display by attaching small soil samples in baggies to a neighborhood map to identify where they were collected.

2.4.2 MAKING SOIL

OBJECTIVES

The students
- Hypothesize about how rocks become soil.
- Crush rocks into soil size particles.
- Make soil from their crushed rock.
- Summarize and speculate about soil formation.

BACKGROUND

The students try to make soil from rock after they have investigated the contents of the soil samples collected in Activity 2.4.1 SOIL. Three methods are suggested. Sand can be pulverized with a hammer, rocks can be crushed with a stamp mill, and weathered or fragile rocks can be broken up by rubbing them together.

Stamp Mill
Make a stamp mill for crushing rock or borrow one from another DASH 2 or DASH 4 teacher if one is not already in the classroom. See figure 2.4.2 for construction. Caution the students not to try breaking the rocks with hammers.

Eye Protection
Eyes should be protected with goggles during this activity. Eyes can also be protected with student made face shields. This is an opportunity for the DASH 5 students to help in making shields. See Activity 2.10.6 SAFETY EQUIPMENT.

Measuring Volume and Mass
Use the procedures from Activity 2.4.1 SOIL to determine the volume and mass of the particles that are produced. The proportions of different sized particles found in Activity 2.4.1 SOIL can be used as a soil recipe.

STUDENT ROLE

Agronomist

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MATERIALS

small rocks to be crushed
large rocks to be dropped on each other
weathered rocks or sand (decomposing granite, sandstone, volcanic tuff)
stamp mill rock crusher
  30 cm (1 ft) of metal pipe 1 and 1/2-inch in diameter
  1 metal cap 1-1/2 inch in diameter
  1 meter (3 ft) of metal pipe 3/4-inch in diameter
  1 metal cap 3/4 inch in diameter
hammer for sand pulverizing only
balance
goggles
graduated containers from Activity 2.10.5 MEASURING VOLUME
balances from Activity 2.10.3 THE BALANCE
sieves from Activity 2.4.1 SOIL
newspaper
thick metal surface for pulverizing sand (a thick concrete surface can be used if hammer marks are of no concern)
Student Page 2.4.2 MAKING SOIL

PRODUCTS

Student-made soil
Completed Student Pages

PROCEDURES

1. **Review the concept map about soil with the class and introduce the problem of making soil.**

   Ask such questions as these:
   - What does soil mostly seem to be made of?
     ✔ Review the contents of the soil they have just analyzed.
   - Where do you think these particles came from originally?
     ✔ Work to the idea that they probably came from rock because they look like little rocks and rocks can be broken up to look like these particles.
   - Do you think you could make soil from rocks? What would you need to do this?

- What danger is there in using a hammer to break up rocks?
  ✔ Get at the idea that rocks can fly when hit with a hammer. Show them the stamp mill and have a student demonstrate how it crushes small rocks.
- Why should you wear goggles or face protectors?
- What else did you find in the soil you analyzed in Activity 2.4.1 SOIL?

2. **Have each group come up with a soil recipe similar to one they analyzed in Activity 2.4.1 SOIL and record it on Student Page 2.4.2 MAKING SOIL. The total volume should be about 125 mL or one half cup of soil.**

Have them include
- Rock particle sizes and proportions.
- Any other ingredients from their analysis that they may wish to add and their proportions.
  ✔ Do *not* add fertilizers since they are ingredients that will not have been seen in the original analysis of soil. The role of fertilizers and chemical nutrients in soil will be dealt with in later DASH work.

3 **Have the students crush small rocks and pulverize sand.**

Help them
- Discover how to pulverize sand using a hammer.
- Discover how to use the stamp mill to crush small rocks.
- Discover that rubbing weathered rocks together breaks them up.
- Collect all pulverized materials after all team members have had a chance to work.

4. **Have student groups sort and measure the amount of soil particles of different sizes they will need to make 125 mL of artificial soil.**

Help them
- Sort the particles by sifting or other methods.

- Weigh or measure the amount of each particle size they put together.
  ✔ Save the sample for Activity 2.4.3 SOIL AND PLANTS.
- Record their data on Student Page 2.4.2 MAKING SOIL.

6. Summarize and speculate about soil formation with the class.

Ask the students such questions as these:

- Have you made the same kind of soil that you found outside?
- How was the soil you made similar to and different from the soil you found outside in Activity 2.4.1 SOIL?
  ✔ Compare the proportions.
- How might big rocks on top of mountains or in streams be made into smaller rocks?
  ✔ Get at the idea that rocks can fall off mountains and rub against each other in streams. You may want to drop larger rocks on each other. Be careful to keep feet out of the way and protect eyes.
- How could big rocks help pulverize sand in streams?
  ✔ Test out ideas.
- Do you have any additions for the concept map about soil?

EXTENSION

- Visit a stream bed or rock slide and look at rocks, sand, and silt for clues to natural soil formation.

ILLUSTRATION

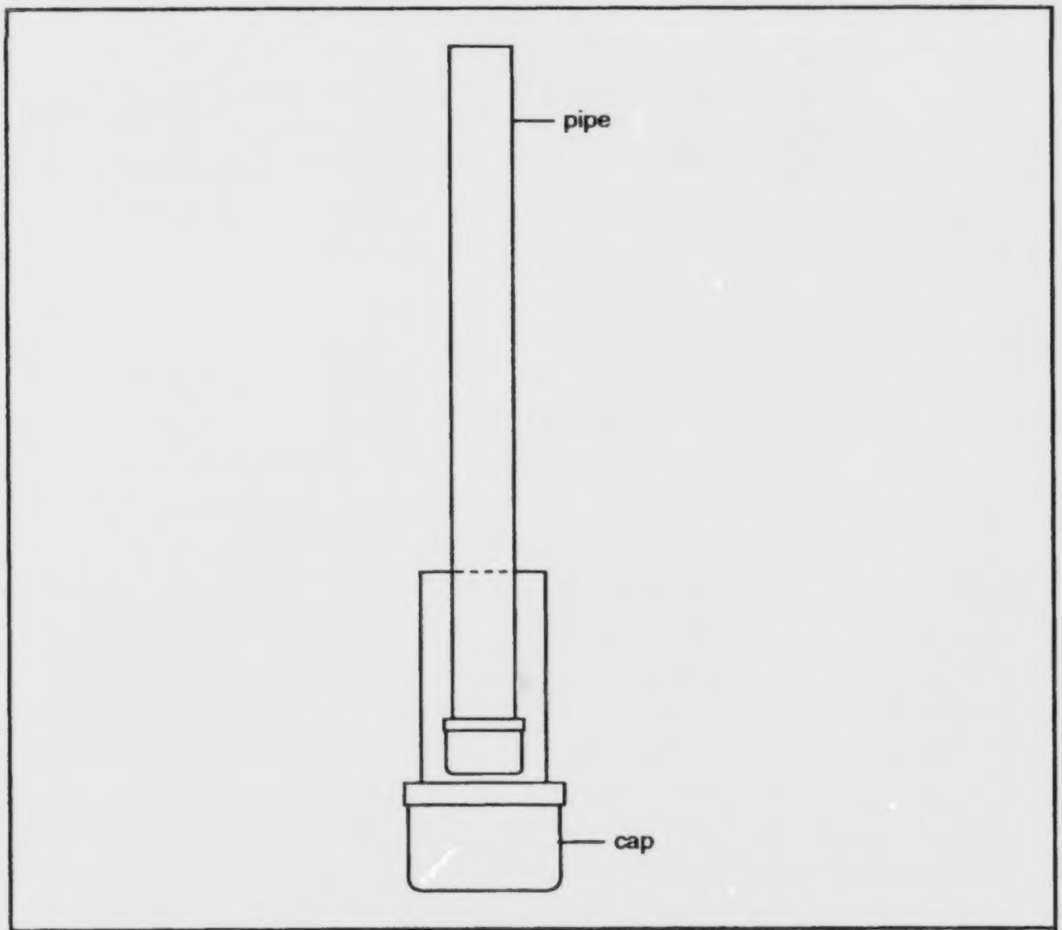

Figure 2.4.2 Stamp mill rock crusher.

2.4.3 SOIL AND PLANTS

OBJECTIVES

The students
- Experiment to see in which soil plants grow best, natural or student made.
- Make hypotheses about what constitutes good soil.

BACKGROUND

This activity follows Activity 2.4.2 MAKING SOIL. In SOIL AND PLANTS the students determine the relative capacity of natural and student-made soils to support the growth of plants.

Suggested Plants
Radishes and bird seed are suggested for testing because they are quick-growing plants.

Growing Conditions
From DASH K and 1 the students will have a fair idea that plants need soil, water, and sunlight or a grow-light to grow. They should use this knowledge to set up the growing conditions for testing their soils. Use window space if possible.

Expected Results
Soil containing oil or other chemicals may prevent the germination of seeds. Soils that are low in soluble nutrients will produce sickly plants. Freshly crushed rock normally will not have much soluble nutrient material. Radishes and bird seed should grow to some degree in both the natural and student-made soil. However, they will usually grow much better in good natural organic soils.

STUDENT ROLE

Agronomist

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MATERIALS

concept map about soil from Activity 2.4.1 SOIL
soil samples from Activities 2.4.1 SOIL and 2.4.2 MAKING SOIL
radish or bird seeds
half-pint milk cartons or recycled plastic or Styrofoam cups for growing chambers
nails to punch holes in the bottoms of chambers
aluminum pie pans or other drainage containers
water
Student Page 2.4.3 SOIL AND PLANTS

PRODUCTS

Team Responsibility Charts
Growing plants
Completed Student Pages

PROCEDURES

1. **Review the concept map about soil with the students and introduce the problem of growing plants in different kinds of soil.**

   Ask such questions as these:
   - What do you know about the relationship between soil and plants?
   - Do you think that plants will grow in all kinds of soil or only some kinds of soil?
     ✓ Have them record their predictions.
   - Will plants grow in the soil you made?
     ✓ Have the students record their predictions.

2. **Have the students invent a way to test their predictions. Remind the students that they have samples of soil from Activities 2.4.1 SOIL and 2.4.2 MAKING SOIL.**

   Help them by
   - Putting half-pint milk cartons, recycled plastic or Styrofoam cups, pie pans, seeds, and other materials in the Inventor's Box.

- Asking how they are going to provide water over weekends.
  ✔ Help them recall using water in pans under growing containers that have holes in the bottom.
- Asking how they are going to provide light.
- Asking how and when they are going to observe their plants.
  ✔ Work toward a schedule for daily observation.

3. **Have the students run the experiments for 20 days or so while making and recording observations daily.**

   Help them
   - Make a team Responsibility Chart.
   - Draw or describe their experiment.
   - Record their observations on Student Page 2.4.3 SOIL AND PLANTS. Use one page for each sample.

4. **Have the students share and compare their experimental results.**

   Ask such questions as these:
   - Did plants grow in all the kinds of soil that you tested?
   - Were your predictions correct? How?
   - Are there kinds of soil that plants might not grow in?
   - Were there some kinds of soil that plants grew better in than others?
   - Which soils seem to have been the best for growing plants?
   - Why do you think these were the better?
   - Which soils seem to have been the worst for growing plants?
   - What kind of soil would you want to use in future growing activities?

EXTENSION

- Have the students grow other kinds of plants in the soils they have made.

2.4.4 SOIL USES

OBJECTIVES

The students
- Develop a working definition of natural soil.
- Explore the uses of soil.

BACKGROUND

This activity is designed to encourage students to observe how soil is used at home, at school, and in the community. SOIL USES is a companion to Activity 2.4.5 FINDING SOIL, and it should follow Activity 2.4.3 SOIL AND PLANTS.

Uses

The students will find that soil is used in many places including gardens, farms, potted plants, fill for house foundations, road work, levees, habitats for small animals, and even as a filter for ground water.

Soil Definition

Natural soil refers to the loose topmost layer of the earth's surface that contains crushed rock materials, organic matter, and supports flourishing plant growth. *Supports flourishing plant growth* means that a wide variety of plants grow and reproduce in it.

Soil is distinguished from sand, gravel, and rocks that are other components of earth's topmost layer in which most plants do not flourish. Another category of material in the top layer in which plants do not flourish is rubble, which is mostly broken building material from human activities.

Approach

The students develop a working definition of soil from their work in Activities 2.4.1 SOIL and 2.4.2 MAKING SOIL. They then look for other ways that soil is used and record them on a class chart about the uses of soil or on their concept map about soils .

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STUDENT ROLE

Agronomist

MATERIALS

chart paper
Working Dictionary
concept map about soil
Student Page 2.4.4 SOIL USES

PRODUCTS

Working definition of soil
Class chart about the uses of soil
Completed Student Pages

PROCEDURES

1. **Review the concept map about soil and the work done to date with soil. Help the class develop a working definition of natural soil.**

   Ask such questions as these:
   - What did you find in your analysis of the soil that you brought in from the field?
     ✔ List the things found in Activity 2.4.1 SOIL, including fine clay, sand, gravel, and plant and animal matter.

   - What did you put in the soil you made?
     ✔ List the things from the recipes in Activity 2.4.2 MAKING SOIL.

   - What were some differences you could see between the natural soils and the soils you made?
     ✔ Get at the idea that the soils that they made were not as fine grained as the natural soil.
     ✔ Usually plants will have grown better in natural soils.

   - What is your working definition of a natural soil?
     ✔ Record the definition in the Working Dictionary.

2. **Introduce the next investigation, *Now that you know what soil is, what are the ways it is used?* Help the students add to their concept map about soils or set up a separate class chart about the uses of soil.**

Have the students

- List things that soil is used for.
  ✔ Have the students work in small groups to list the things that soil is used for and where they have seen it used this way.

- Organize a class chart about uses of soil using these group inputs or add these to the exiting concept map about soils.

- Find additional uses for soil different from those already listed.
  ✔ To get as an extensive listing as possible, have each student find at least 2 uses not already on the chart or concept map as a home assignment. Use Student Page 2.4.4 SOIL USES.

- Report on the uses and add them to the chart or concept map.
  ✔ Keep the chart or concept map up for awhile and have the students add to it whenever they see a new use for soil.

EXTENSION

- Have the students write a story about soil's contribution to their lives.

2.4.5 FINDING SOIL

OBJECTIVES

The students
- Refine their working definition of natural soil.
- Determine what kinds of things on the earth's surface can be considered to be natural soils.

BACKGROUND

In this activity the students find things that can and cannot meet their definition of soil. FINDING SOIL is a companion to Activity 2.4.4 SOIL USES and follows after it.

Approach

The students are asked to find things that are part of the earth's surface that do or do not meet their definition of a natural soil. In Activity 2.4.4 SOIL USES they developed a working definition of natural soil. This definition usually includes the capacity of natural soils to support abundant and varied plant growth. In FINDING SOIL the students use their definition and are asked to find other components of the earth's topmost layer that support and don't support good plant growth. The students invent their own tests of the capability of these components to support plant growth. The procedures used in Activity 2.4.3 SOIL AND PLANTS can again be used.

Non-soil Components

Things in the topmost earth layer that don't support good plant growth and are not considered to be soil include sand-covered areas, rocks, gravel bars, chemical-covered ground, concrete and asphalt-covered ground, and others. These may support some limited growth but not flourishing growth of a wide variety of plants.

STUDENT ROLE

Agronomist

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MATERIALS

magnifying glasses
sieves from Activity 2.4.1 SOIL
growing chambers
bird seed
radishes
chart paper
Working Dictionary
Student Page 2.4.5 SOIL SAMPLE REPORT

PRODUCTS

Completed Student Pages

PROCEDURES

1. **Review the working definition of natural soil recorded in the Working Dictionary. Where needed expand the definition to include soil's support good growth in different plants.**

   Ask such questions as these:
   - What is natural soil composed of?
   - How is the support of life used to identify the presence of natural soil?

2. **Introduce the investigation problem, *What kinds of things are found to be soils or like soils?***

   Ask such questions as these:
   - Is the dirt in a vacuum sweeper soil? Can plants grow well in it if they are watered?
   - Is stream sand soil? Can plants grow well in it if they are watered?
   - Can plants grow well in broken pieces of asphalt if they are watered?
   - Can plants grow well in broken concrete if they are watered?
   - Can plants grow well in clay if they are watered?

- What are some other things that are part of the earth's surface that you can test to see if plants will grow in them?

3. Have the students invent tests for materials found in or on the earth to answer the question, *What kinds of things are found to be soils or like soils?*

Have the students
- Carry out their investigations.
- Describe their results on Student Page 2.4.5 SOIL SAMPLE REPORT.
- Report to the class as they get answers to their research.
  ✔ Have them post their reports for others to see.

EXTENSION

- Have the students make a bulletin board display with the samples of the soil or soil-like earth they have tested.

2.4.6 PIPES AND WATER

OBJECTIVES

The students
- Observe how water moves through the school.
- Observe the ways water is used in the school.

BACKGROUND

This is a review activity to be used if students did not have this experience in DASH 1. In this activity the students observe how water is moved from one place to another. This is also an opportunity to discuss the history of the technology of moving water, the many uses of water, and the need for water conservation.

This is a localized activity that will depend on the accessibility of the school's water pipes. Enlist the help of the school custodian to give the tour if possible.

STUDENT ROLE

Water engineer

MATERIALS

chart paper
markers
Student Page 2.4.6 PIPES AND WATER

PRODUCTS

Map or mural about the school's water system
Completed Student Pages

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PROCEDURES

1. **Introduce the activity by turning off the classroom water supply at the valve while the students are out of the room. Wait for them to discover the problem. Have students turn on the water.**

   Ask such questions as these:
   - Why do we need a water valve in our classroom?
     ✔ Get at the idea of being able to fix the sink or faucet.
   - Where else are there water faucets and valves in our school?
   - How does the water get from place to place in our school?
   - How does water get to our school?
   - What do you think pipes are made of?
   - What would people have to do to get water if there were no pipes or water systems?
   - Does anyone have a well for water?
   - Has anyone used a pump to get water?

2. **Tour the school with the class to observe and trace the water system.**

3. **Discuss and map the school's water system on a class mural about the school's water system."**

   Ask such questions as these:
   - Why do we need water valves?
   - Where does the water coming to us go first? Next?
   - How is water used in our school?
     ✔ For heating, cooking, toilets, drinking fountains, classroom sinks, sprinkler system, etc.
   - Where does the dirty water go?
   - What happens when we waste water?
     ✔ Get at cost and the need to conserve water.

4. Have the students report on their home water system using Student Page 2.4.6 PIPES AND WATER.

EXTENSIONS

- Take a trip to see where the local water supply originates or visit a water treatment plant.
- Read *The Magic School Bus at the Waterworks* by Joanna Cole.
- Investigate why only certain materials are used for pipes. This could be done with the decomposition activities.

2.4.7 MOVING WATER

OBJECTIVES

The students
- Invent ways to move water from one place to another.
- Discover ways to regulate the flow of water.
- Discover how a siphon works.

BACKGROUND

MOVING WATER is a *wet activity* and should be done on an uncarpeted floor, outdoors, or some other place where water can be spilled without concern. This activity is designed to explore moving water from one place to another using gravity. It is followed by 2.4.8 MOVING WATER WITH PUMPS. Use the Inventor's Box to hold a wide variety of possibly useful items.

Problems

There are four major problems for invention with additional challenges. The students are given the opportunity to explore freely each within the bounds of safety and courtesy. Present all work as a research.

Encourage invention. Begin the activity as an open inquiry. Use Socratic questioning to give the students clues if they get frustrated. Have the students share their discoveries. Demonstrate how to assemble equipment *only* as a last resort. For equipment setups see Figure 2.4.7(1–4).

Approach

This is a teacher facilitated sequence. Present new problems and challenges as student groups solve earlier ones. Each group should try to find solutions to the four numbered problems and some of the challenges. Not all groups need confront all challenges. Problem 4 will prove to be a challenge. It is illustrated in Figure 2.4.7(4) where groups are to try to get water to flow uphill. The solution to this problem is found in Activity 2.4.8 MOVING WATER WITH PUMPS. The diagrams in Figures 2.4.7(1–4) can be shown on an overhead projector or drawn on the board for students to clarify the problems without destroying the potential for invention.

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Water Sources
Plastic bottles are excellent containers. They can be cut in half. The tops can be used to deliver water and the bottoms can be used to receive water. Cutting should be in the control of the teacher.

Stoppers
Tubing can be secured in the opening of a bottle by wrapping the tubing with cloth and forcing it into the opening. This technique, though drippy, can accommodate several tubes and is one that the students can use at home.

Alternatives. Holes can be drilled in bottle caps a little smaller than the tubing. When tubing is pushed into the hole, little or no water will leak. Caps can be screwed onto plastic bottles. This is the method shown in the diagrams. Standard corks or rubber stoppers can be bored and metal, plastic, or glass connectors can be used to hold the tubing. The students will invent numerous systems when duct tape, sponge pieces, and floral clay are available.

Siphon
Water will flow from one container to another through a hose or tubing that carries water *over a hill* when two requirements are met. First, the level of the water in the source must be higher than the level of the water outlet or receiving container. Second, the hose must be completely filled with water at all times. See Figure 2.4.7(3).Such a system is called a *siphon.* A siphon is particularly convenient for emptying aquariums. See Activity 2.3.1 THE CLASSROOM AQUARIUM.

Filling the Tubing
Completely fill a piece of tubing or a hose by putting it in a bucket of water. Let the air escape from the tubing. Place fingers over the ends to prevent the water from running out and put one end of the tubing in the source container and the other in the receiving container. For sanitation reasons caution the students not to suck on the tubing.

STUDENT ROLE

Hydrology engineer

MATERIALS

tin cans and other plastic containers
plastic bottles cut in half (use both tops and bottoms)
plastic bottles (uncut)
caps for bottles (these may be predrilled to hold tubing)

clear plastic tubing (multiple diameters)
plastic straws
cork borer (optional)
stoppers (Styrofoam, cork, rubber) (optional)
rigid connecting tubing (plastic, metal, glass—*use caution*) (optional)
rags for stoppers
sponge pieces for stoppers
buckets
clothespins
paper clips
wire coat hangers
string
floral clay
duct tape
hand drill and bits
razor blade knife or universal scissors to cut bottles (*For teacher use only)*
Student Page 2.4.7 MOVING WATER

PRODUCTS

Invented water systems
Completed Student Pages

PROCEDURES

1. **Introduce the inquiry to the students by discussing the need to control the movement of water from one place to another. Explain that they will be given a series of engineering problems to solve. Go over safety and other issues concerning leaky systems.**

2. **Present Problem 1: Invent a system to move water from one container to another container one meter away. See Figure 2.4.7(1). This will involve a tube and raising the water source above the container. Demonstrate one way of connecting tubing to bottles if necessary.**

   Some additional challenges:
   - Can you invent a way to fill a container slowly while you are one meter away from it?
     ✔ This will probably involve inventing a way to cut down the flow.

- Can you invent a way to fill a container quickly?
  ✔ This will probably involve such things as holding the source container higher, increasing the number of tubes, and changing tube size.

3. **Present Problem 2: Invent a way of delivering water at the same time to two different places that are each one meter away from the water-source container. See Figure 2.4.7(2). This will involve at least 2 tubes and raising the water source above the container.**

   Some additional challenges:
   - Can you invent a way to slowly fill both containers at the same time while you are somewhere else?

   - Can you invent a way to quickly fill one containers while slowly filling the other.

   - Can you invent a way to fill one container, stop the water, and then fill the other container?
     ✔ This will probably involve inventing a valve system, possibly using clothespins or simply pinching the tube.

4. **Present Problem 3: Invent a way to get water to flow from one container to another over a hill. See Figure 2.4.7(3) and the Background on the siphon.**

   Additional challenge:
   - How high a hill can you get the water to flow over?
     ✔ The height will be limited by the available equipment.
     ✔ Name this special kind of system a *siphon.*

5. **Have the students explore freely, creating and solving their own problems.**

   Suggest some additional challenges:
   - Can you keep a system with one container delivering water continuously all day without adding water?
     ✔ Solutions might include drip systems, very large source tanks, and so forth.

   - How can you bring a hose over the edge of a bucket without pinching off the water?
     ✔ A solution might be taping a hose to the more gentle bend of a wire.

- Can you deliver water across the room to the sink by routing it along the floor? If so, how?
  ✔ They will find that they can if the water level in the source is higher than the sink.

- Can you deliver water to the other side to the room by routing it across the ceiling? If so how?
  ✔ They will find that they can if the water level in the source is higher than the sink and they have a filled siphon tube.

- Can you deliver water to another container when the water levels in the two containers are the same height? If so, how?
  ✔ Water will not flow.

- Can you get water to flow through a siphon while keeping the water in the containers the same height? If so, how?
  ✔ Water will not flow.

6. **Present Problem 4: Invent a way to get water to flow only uphill. Emphasize that this is not up hill and down as with a siphon. See Figure 2.4.7(4).**

   Help them
   - Try such things as adding more water to the lower container, starting a siphon and carrying it up before it is released, and so forth.
     ✔ Water will not flow uphill. The students will find that water will flow only from the higher to a lower level, not the reverse.

7. **Have the student groups describe and demonstrate what they have done to solve the problems and challenges. Have them record their group solutions on Student Page 2.4.7 MOVING WATER.**

   Some suggested questions are:
   - What did you find in your water experiments?

   - When using a siphon, was anyone able to get water to go to a higher level than the water source container?
     ✔ Yes, but it always had to come down through a hose and the receiver always had to be lower than the sources.

   - Was anyone able to get water to flow uphill only?
     ✔ The expected answer is no. If they answer yes, have them demonstrate.

- Do streams and rivers flow uphill, downhill, or both?
  ✓ The expected answer is downhill only.

- How do we get water into water tanks and mountain reservoirs?
  ✓ This question leads to the next Activity 2.4.8 MOVING WATER WITH PUMPS.

EXTENSION

- Hold a follow-up moving-water exploration to allow students to test new solutions to the problems presented in this activity and other related problems of their own invention.

ILLUSTRATIONS

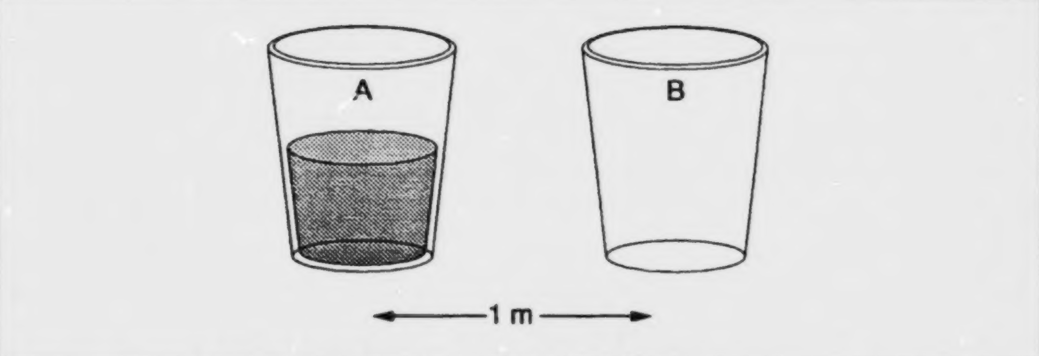

Figure 2.4.7(1) Problem 1.
Move water from container *A* to container *B*.

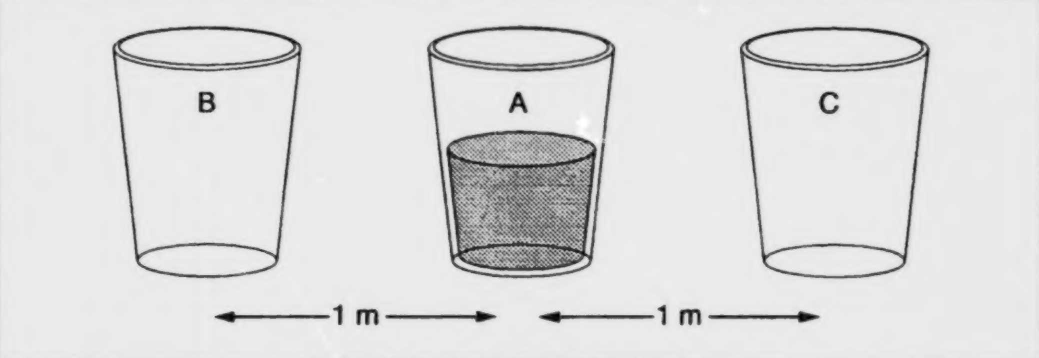

Figure 2.4.7(2) Problem 2.
Move water from container *A* to containers *B* and *C*.

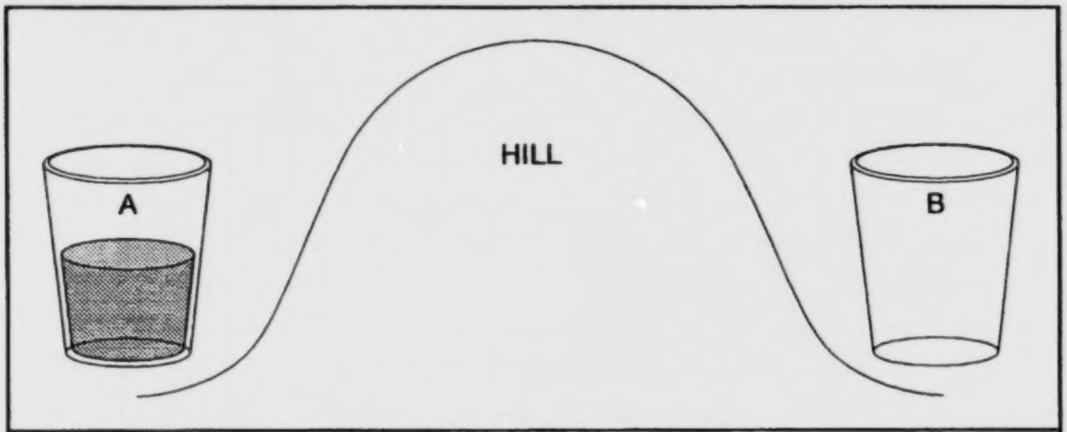

Figure 2.4.7(3) Problem 3.
Move water from container *A* over a hill to container *B*.

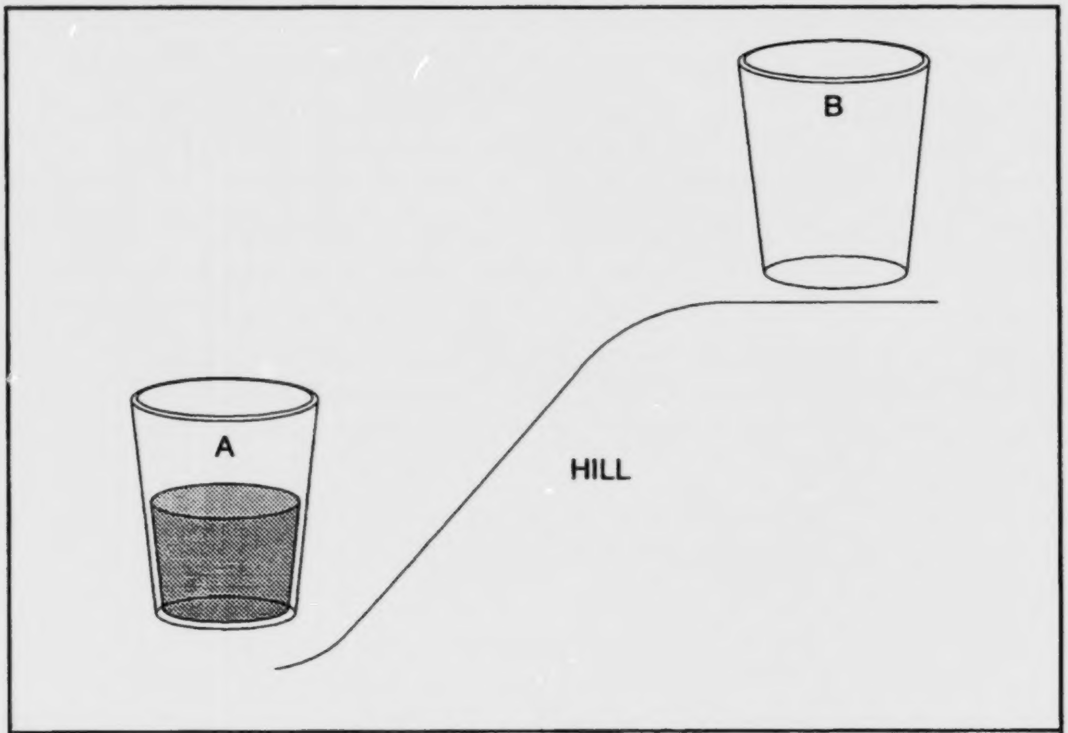

Figure 2.4.7(4) Problem 4.
Move water from container *A* up a hill to container *B*.

2.4.8 MOVING WATER WITH PUMPS

OBJECTIVES

The students
- Make a syringe-type pump.
- Observe that pumps can push or pull water uphill.

BACKGROUND

MOVING WATER WITH PUMPS is a *wet* activity and should be done on an uncarpeted floor, outdoors, or some other place where water can be spilled without concern. This activity follows 2.4.7 MOVING WATER and is designed to explore moving water from one place to another using a syringe-type pump. Use the Inventor's Box to hold a wide variety of possibly useful items.

Syringe Pump

Make a syringe-type pump from 2 plastic bottles of slightly different sizes. Cut out the bottom of the larger bottle to act as the barrel of the pump. Wrap the smaller plastic bottle with duct tape to make a snug fitting piston loose enough to be easily push backwards and forwards. A more air tight seal can be made by greasing the tape on the piston with petroleum jelly. Attach tubing to the bottle cap opening on the barrel. See Figure 2.4.8.

Stoppers

Tubing can be secured in the opening of a bottle by wrapping the tubing with cloth or a piece of sponge and packing it tightly into the opening. Though drippy, this method can accommodate several tubes and is one that the students can use at home. This method will probably work best here. For alternatives see Activity 2.4.7 MOVING WATER.

Problems

There are four problems for invention with several challenges. The students are given the opportunity to explore each problem freely within the bounds of safety and courtesy. Present this as a research activity.

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Approach

Again this is a teacher facilitated sequence of investigations like Activity 2.4.7 MOVING WATER. A demonstration pump should be assembled with the students. The students need to practice using the pump, getting a feel for the way it works. The pump can be used to push water up a hill and to pull it up a hill. How pumps do this is part of the invention.

Continuous Operating Pump.

The pump need not be disconnected from the system to fill and empty it if two tubes are put into the nozzle of the pump. By closing off the output tube through which the water is expelled water can be drawn into the pump through the input tube. Then, when the pump is full, close the input tube, open the output tube, and expel the water through the output tube. Clothespins and binder clamps make good valves. See Procedure 7.

STUDENT ROLE

Hydrology engineer

MATERIALS

tin cans and other plastic containers
plastic bottles
caps for bottles (these may be predrilled to hold tubing)
clear plastic tubing (multiple diameters)
plastic straws
cork borer (optional)
stoppers (Styrofoam, cork, rubber) (optional)
rigid connecting tubing (plastic, metal, glass—*use caution*) (optional)
rags for stoppers
sponge pieces for stoppers
buckets
clothespins
binder clips
paper clips
wire coat hangers
string
floral clay
duct tape
petroleum jelly
hand drill and bits
razor blade knife or universal scissors to cut bottles (*For teacher use only*)
Student Page 2.4.8 MOVING WATER WITH PUMPS

PRODUCTS

Invented pump systems
Completed Student Pages

PROCEDURES

1. **Have the students review the work done in the Activity 2.4.7 MOVING WATER.**

   Ask such questions as these:
   - When using the siphon, was anyone able to get the water to a container at a higher level than the water source?
     ✔ If any students say yes, have them demonstrate how they got the siphon to go uphill. Their invention or failure will establish the nature of the problem confronted here, which is how to get water to move uphill.
   - Do rivers and streams flow uphill or downhill?
   - How do we get water up to city water tanks or mountain reservoirs?
     ✔ Lead the discussion around to the need for a device to push or pull water up to the tank or reservoir. Call such a device a *pump*.

2. **Introduce the inquiry to the students by discussing ways to move water up a hill. Explain that they will be given a series of engineering problems to solve. Review safety and other issues concerning leaky systems.**

3. **Demonstrate the construction of a pump. Have each group make one and encourage modifications. See Figure 2.4.8.**

4. **Present Problem 1: Invent ways to fill the pump without pouring water into it and then expelling it.**

   Have student groups
   - Test to see that the piston moves back and forth freely in the barrel.
   - Attach a plastic hose or tubing to the pump and invent a way to draw water into the barrel.

- Point the hose into a container and invent a way to expel the water.

- Explore how the pump works to take up and expel water.

5. **Present Problem 2: Invent a way to get pumps to push water as high as possible.**

   Have each student group
   - Invent their own system.
     ✔ Anticipate that some students will shoot the water into the air, others may use tubes, still others may use combinations of these and other ideas. Insist that they take precautions not to get other researchers wet and clean up their spills.

   - Demonstrate their system and tell how it works.

   - Discuss which of all the systems allowed them to get the water the highest.

   - Discuss which of all the systems gave them the greatest ability to control the water that was pushed up.
     ✔ Work for the idea that the hose gives them more control as to where the water will go, such as around corners.

6. **Present Problem 3: Invent a way to use a pump to pull water up a hill as far as possible.**

   Have each student group
   - Invent their own system.

   - Demonstrate their system and tell how it works.

   - Discuss which of all the systems allowed them to get the water the highest. Why?

   - Discuss which system gave them the greatest ability to control the water that was pulled up.

7. **Present Problem 4: Invent a two tube pump system that pushes or pulls water up to a tank or reservoir and empties its contents without being disconnected. See Background.**

8. **Present some additional challenge inventions to the students.**

- Invent a pump system that allows one to move water higher than it was pushed in Problem 2.
  ✓ This can be done by a pump that first draws water to a certain height then pushes it higher.

9. **Have the students record group inventions on Student Page 2.4.8 MOVING WATER WITH PUMPS.**

10. **Have the students demonstrate their systems and tell how they work. Discuss which systems work best and what is meant by best.**

11. **Have the students explore freely, asking their own questions and finding their own answers.**

    Ask such questions as these:
    - How might you take more water into your pump each minute with your present system?

    - Is it harder to push the water through a small hole or a large hole?

EXTENSION

- Have the students research water pumps and make models of them.

ILLUSTRATION

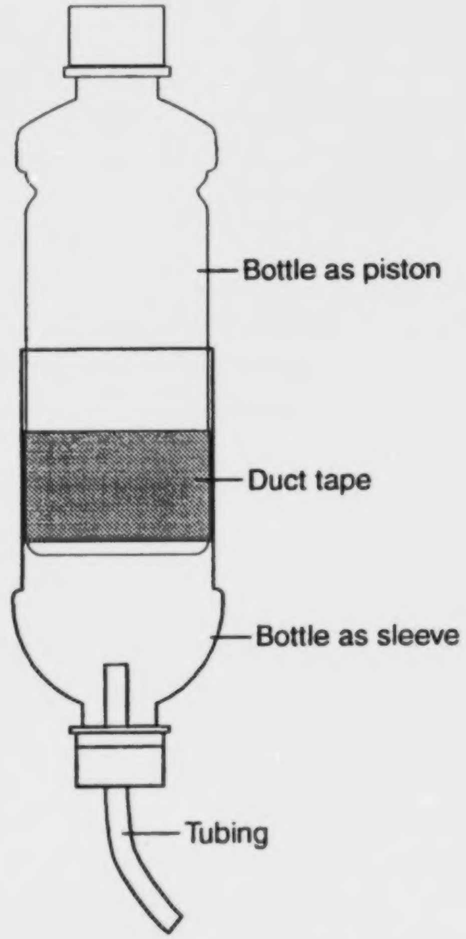
Bottle as piston
Duct tape
Bottle as sleeve
Tubing

Figure 2.4.8 Syringe-type pump.

2.4.9 VEGETABLE GARDEN IN A BUCKET

OBJECTIVES

The students
- Plan a vegetable garden in a small container.
- Recycle Styrofoam for use as a component in a growing medium.
- Grow snack foods in their gardens.

BACKGROUND

This activity is companion to and can be done concurrently with Activity 2.4.10 FLOWER GARDEN IN A BUCKET. Together they carry on the gardening theme begun in kindergarten. The students plant and grow vegetables in a small container. This activity can also provide vegetables for Activities 2.5.5 IDENTIFYING PROPERTIES OF VEGETABLES and 2.5.6 CHANGING FLAVOR. This activity provides an opportunity to use the volumetric measuring containers invented in Activity 2.10.5 MEASURING VOLUME.

Vegetables

Any vegetable can be used in this activity when properly supported, but those that reach a height *under* 30 cm or one foot are preferable. Stress should be on vegetables that can be used as snacks (radishes, carrots, lettuce, spinach, cherry tomatoes, and so forth). This activity can be run through the winter if buildings are kept fairly warm on weekends. Instructions for planting seeds are found on the backs of seed packets.

Growing Medium

Make a well-aerated growing medium by mixing one-half cup (approximately 125 mL) of granulated Styrofoam with one cup of compost (approximately 250 mL) and 2 and 1/2 cups (approximately 625 mL) of soil. Stress the recycling of materials. Styrofoam can be shredded by rubbing small pieces through hardware cloth or screen (1/4-inch mesh). Use volume measuring containers from Activity 2.10.5 MEASURING VOLUME.

Watering

Put holes in the bottom of cans or other *buckets*. These *buckets* can then be put in a tray or pan of water. The water in contact with the soil will keep it moist. If students water their plants too heavily, excess water will flow out the bottom.

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STUDENT ROLE

Gardener

MATERIALS

volume containers from Activity 2.10.5 MEASURING VOLUME
granulated or shredded Styrofoam
hardware cloth or screen with 1/4-inch mesh to shred Styrofoam
soil
compost
vegetable seed
tin cans or plastic containers of gallon size (*buckets*)
trays for watering growing *buckets*
large nails to make holes in *buckets*
hammers
Student Page 2.4.9 VEGETABLE GARDEN IN A BUCKET

PRODUCTS

Responsibility Chart
Gardens in buckets
Completed Student Pages

PROCEDURES

1. **Introduce the activity of growing snack vegetables in a bucket.**

   Ask such questions as these:
   - How could you grow something if you didn't have a garden?
   - What would you need to make a *bucket garden*?
     ✔ Describe the bucket system.
   - What vegetables might you grow in a *bucket garden*?

2. **Have the students plan for what they will need for their bucket gardens.**

   Have them
   - Consider having a wide variety of vegetables for snacks.
     ✔ This will be an ideal time to look at seed packets and see which vegetables can be grown quickly.

- Consider the materials, location, time needed to grow plants, care that will be required, and new jobs for the Responsibility Chart.

- Plan a watering system.
  ✔ This may give the students a chance to use their knowledge of siphons and other water delivery devices, especially if the water source is some distance from where their *bucket garden* will sit.

- Add jobs to the a Responsibility Chart.

3. **Have the students prepare the soil, make watering systems, set up the gardens, and plant the seeds. See Background.**

   - Shred Styrofoam for planting mix.
     ✔ Emphasize the recycling of materials.

   - Make potting soil.
     ✔ Use proportions one-half cup (approximately 125 mL) of granulated Styrofoam, to one cup of compost (approximately 250 mL), to 2-1/2 cups (approximately 625 mL) of soil.
     ✔ Use volume measuring containers from Activity 2.10.5 MEASURING VOLUME.

   - Put holes in the bottoms of cans or other buckets and setup watering trays.

   - Invent a watering system.

   - Plant seed.

4. **Have the students observe and record the development of the plants using Student Page 2.4.9 VEGETABLE GARDEN IN A BUCKET.**

5. **When the vegetables are ready to harvest use them as the snack of the day. Use this as another opportunity to get the students to widen their eating habits. See Activity 2.5.6 CHANGING FLAVOR.**

6. **Review the activity.**
   Ask such questions as these:
   - How could you make a better bucket garden next time?

   - What are the advantages and disadvantages of bucket gardening?

- Why did you add Styrofoam to the potting soil?
  ✓ Get at aeration. The soil cannot be easily cultivated in a bucket.
- How well did your watering system work?

EXTENSION

- Suggest to parents that they make a bucket garden near a window at home to stress that school is not the only place where such gardens can be grown.

2.4.10 FLOWER GARDEN IN A BUCKET

OBJECTIVES

The students
- Plan a flower garden in a small container.
- Recycle Styrofoam for use as a component in a growing medium.
- Grow flowers for their aesthetic qualities.

BACKGROUND

This activity is a companion to Activities 2.4.9 VEGETABLE GARDEN IN A BUCKET and 2.4.11 PLANTS AND SUNLIGHT and can be run concurrently with both. In FLOWER GARDEN IN A BUCKET students plant and grow a flower garden in a small container.

Plants

Any house plant can be used in this activity, but small ones will be most convenient. This activity can be done during the winter if buildings are kept fairly warm on weekends. The students can be asked to visit their local garden shop or talk with a home gardener for suggestions about good plants to grow. Growing directions are found on the backs of seed packets. See Activity 2.4.9 VEGETABLE GARDEN IN A BUCKET for suggestions for making a growing medium using Styrofoam and for watering plants.

STUDENT ROLES

Horticulturist
Gardener

MATERIALS

volume containers from Activity 2.10.5 MEASURING VOLUME.
granulated or shredded Styrofoam
hardware cloth or screen with 1/4-inch mesh to shred Styrofoam
soil
compost
flower seed

BEST COPY AVAILABLE

tin cans or plastic containers of gallon size (*buckets*)
trays for watering growing *buckets*
large nails to make holes in *buckets*
hammers
Responsibility Chart
Student Page 2.4.10 FLOWER GARDEN IN A BUCKET

PRODUCTS

Flower gardens in buckets
Completed Student Pages

PROCEDURES

1. **Introduce the activity by announcing the need to have flowers to brighten up the classroom environment.**

   Ask such questions as these:
   - Where do flowers grow?
   - Why do people want small gardens?
   - What do you need to make a flower bucket garden?
   - How could you find out what kinds of flowers to grow?

2. **Have the students plan their bucket gardens.**

   Have them
   - Consider the materials needed, a place to put plants, the light needed, the care the plants need, and jobs for the Responsibility Chart.
   - Design a watering system.

3. **Have the students prepare the soil, set up the gardens, watering systems, and plant their seeds. See Activity 2.4.9 VEGETABLE GARDEN IN A BUCKET.**

   - Shred Styrofoam for planting mix.
     ✔ Emphasize the recycling of materials.

- Make potting soil.
  ✔ Use proportions one-half cup (approximately 125 mL) of granulated Styrofoam, to one cup of compost (approximately 250 mL), to 2-1/2 cups (approximately 625 mL) of soil.
  ✔ Use volume measuring containers from Activity 2.10.5 MEASURING VOLUME.
- Put holes in the bottoms of cans or other buckets and setup watering trays.
- Create a watering system.
- Plant seed.

4. **Have the students observe and record the development of plants using Student Page 2.4.10 FLOWER GARDEN IN A BUCKET.**

5. **Review the activity.**

   Ask such questions as these:
   - How could you make a better bucket garden next time?
   - What are the advantages and disadvantages of bucket gardening?

EXTENSION

- As flowers bloom have a *flower of the day or week.*
- Have the students make cut-flower arrangements.

2.4.11 PLANTS AND SUNLIGHT

OBJECTIVES

The students
- Grow plants in different light environments.
- Compare the growth of plants in different light environments.

BACKGROUND

Some plants do well in direct sunlight, others do not. In this activity plants that need a relatively large amount of light—common garden flowers and vegetables, are used. Under the pretense of a need for space, some plants are grown in direct sunlight and some in a dark cupboard, closet, or in a box in a cool place. Boxes can be lined with black plastic bags to shield them from light and protect surfaces from water.

Timing

This activity should follow Activities 2.4.7–2.4.10 where the background for planting and inventing a watering system is presented. Since the investigation needs little maintenance, it can be pursued as long as the students have ideas to explore.

Expected Results

The students discover that plants grown in the absence of light do not turn green and that root vegetables do not enlarge. Beans make an excellent plant to study here. Out of these preliminary observations, student experiments emerge.

Some questions that can be explored are
- Will plants grown in the dark recover when put in light?
- Will green plants put into the dark change?
- How much sun do plants need to have?
- Can we use sources of light other than the sun to grow plants?

It is not necessary to explore all or any of the questions above. It is important to explore the questions that the students develop after seeing plants deprived of light.

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STUDENT ROLES

Horticulturist
Botanist

MATERIALS

granulated Styrofoam
soil
compost
large tin cans or plastic containers
dark closet or cupboard
seed (bean)
buckets
plastic tubing
clothespins
Student Page 2.4.11A PLANT EXPERIMENT PLAN
Student Page 2.4.11B PLANT CARE AND OBSERVATIONS

PRODUCTS

Completed Student Pages

PROCEDURES

1. **Note the need to grow bean plants to see what happens when they are not disturbed. Then *discover* that there will only be enough room for two or three to be grown at the window.**

   Have the students
   - Discuss what will happen to plants it they are not disturbed while they grow?
     ✔ Get at the idea that disturbed means moving them. If one is in a corner it stays in the corner, if it is in a drawer or a box on a shelf you don't open the drawer except to check them periodically.

   - Discuss where else in the room plants might be grown.
     ✔ Be sure to include a drawer, box ,or dark place.

   - Prepare and plant bucket gardens.

2. **Have the students invent automatic watering systems for the plants so they are not disturbed.**

3. **Have the students inspect the plants at one-week intervals for two to three weeks. Keep the inspection to no longer than a minute. If a watering system needs repairing keep the plant covered during repairs.**

Ask such questions as these:

- What did you observe about the undisturbed plants?
  ✔ They may bend toward light sources.

- How are your plants growing?

- Is anyone having trouble with their plants? If so, what is the problem?
  ✔ After two weeks any plants that have been in the dark will usually be quite white.

- What could cause the problem?
  ✔ Go over the needs of plants that we know and check to see that they have been satisfied. Work to include the idea that there might be a need for light.

- How can you test your idea about the cause of the problem?

4. **Have the students plan and set up their experiments using Student Page 2.4.11A PLANT EXPERIMENT PLAN.**

Have them

- Write out the question or problem that they plan to explore.

- Decide how they are going to look for an answer to their question.

- Set up their experiment.

- Draw a picture of their experiment and describe what is being done.

- Predict and record what they think will happen.

- Have them decide on a schedule to observe their plants.

5. **Have the students carry out their experiments and record their observations on Student Page 2.4.11B PLANT CARE AND OBSERVATIONS.**

6. **Have the students report their observations and results to the class.**

   Ask such questions as these:
   - What did you think might happen in your experiment?
   - What actually did happen?
   - What do the results of your experiment tell you?

EXTENSION

- Have the students look for plants that grow well in dark places.

2.4.12 ROOTING STEMS

OBJECTIVES

The students
- Explore root development on stems.
- Transplant and grow rooted stems.
- Revise their working definitions of plants and living things.

BACKGROUND

This is the first of a series of activities to explore the function of roots. It is an ideal project for early spring. The students discover how to grow a plant from a stem and revise their idea of when plant matter is living. Some stems have a special ability to develop roots when put in water. Pussy willow, forsythias, ti, and hibiscus will show dramatic root production in water. Many house plants are easily rooted in water.

Rooting Plant Parts

For this activity, place stems in plain water. Change water frequently to prevent molding. Rooting hormones or solutions may also be used. Follow the instructions on the package. Plants that are going to grow will show the development of root buds within a week or so.

STUDENT ROLE

Horticulturist

MATERIALS

glass or plastic jars
scissors, garden variety
water
fresh small woody branches or other cutting known to grow roots
potting soil
root starter (*optional*)
Working Dictionary
Student Page 2.4.12 ROOTS AND STEMS

BEST COPY AVAILABLE

PRODUCTS

Growing plants
Revised working definitions of plants and living things
Completed Student Pages

PROCEDURES

1. **Prepare for the inquiry by having the students bring in small, fresh, woody-branches or other cuttings known to root to decorate the room. Explain that to increase the life of the stems we will dip them in a rooting solution (optional).**

2. **After a week have the students change the water for the plant cuttings that *still look nice.***

3. **Watch to see whether there are any roots or root buds. If the students don't find such growth, arouse their curiosity.**

   Ask such questions as these:
   - What are those white things?
   - Do those leaves look dead?
   - Is your plant growing?
   - Was the stem living or dead when you put it in water?
   - What do you think will happen if you put it back in water?

4. **Return the fresh looking or rooting stems to the water or solution. Help the students observe root growth and record their data on Student Page 2.4.12 ROOTS AND STEMS or on a class chart.**

   Ask such questions as these:
   - What changes are you seeing?
   - How can you tell that there is a change?
   - What does the water seem to be doing?
   - Is the stem alive?
   - How can you tell if the stem is alive?

✔ Develop the idea that it might grow in the ground like other plants if planted.

- What would you have to do to test your idea?
- What would you look for to show that your stem is growing?

5. **Demonstrate how stems with roots can be planted in wet potting soil. This should be done gently to prevent breaking the roots.**

6. **Help the students decide on what evidence they need to determine if their stems are living. Have them continue to record their observations.**

7. **Discuss the students' observations after sufficient time has passed to show evidence of growth in the plant stem.**

Ask such questions as these:
- Is your stem living?
- What evidence do you have for your statement?
- When is a stem living? When is it dead?

8. **Have the students record any changes or additions to their working definitions of living things and plants in the Working Dictionary.**

Ask such questions as these:
- Were your stems living or not living things?
- What do you need to do to tell if a plant is living or not living?
- If a *stem* is found to be living, what is a plant?

EXTENSION

- Have the students transplant thriving plants to beautify the school campus. Work with the groundskeepers.

2.4.13 ROOTING BULBS AND TUBERS

OBJECTIVES

The students
- Explore different plant parts for root development.
- Identify parts of plants that will support root growth.
- Identify methods for starting roots.
- Revise their working definition for living things and plants.

BACKGROUND

This is an open-ended exploration of bulbs and tubers. The investigation should be started after the Activity 2.4.12 ROOTING STEMS has reached the point of watching roots growing in a jar.

Rooting

In this activity the students are shown tubers and bulbs that they usually associate with food such as onions and potatoes. Usually they have not considered them to be alive. By slightly moistening the sacks in which they are kept, potatoes and onions will start to root. Here the students extend their study of roots as further evidence for life in plant parts.

STUDENT ROLE

Horticulturist

MATERIALS

Working Dictionary
glass or plastic jars
rooting solution (*optional*)
water
potatoes (white and sweet)
onions
toothpicks
Student Page 2.4.13 ROOTING BULBS AND TUBERS

BEST COPY AVAILABLE

PRODUCTS

Growing plants
Revised working definitions
Completed Student Pages

PROCEDURES

1. **Prepare for the inquiry by bringing in a few potatoes and onions two weeks before the activity is to begin.**

   In preparation
   - Store potatoes and onions out of sight in a cloth sack placed in a pan.
     ✔ Sweet potatoes will produce a more dramatic growth than white potatoes.
   - The storage area should not get below 60°F (15°C).
   - Start the growth by moistening the sack.
   - Check periodically for mold.
     ✔ Carefully wash off mold in a very weak solution of Clorox. Make a solution of 1 tsp. Clorox to 1 cup of water. After washing rinse with fresh water. If mold appears wash the sack in the same solution and rinse it.

2. **While the students are observing the growth of roots on stems during Activity 2.4.12 ROOTING STEMS, bring out the sack with the potatoes and onions.**

   Ask such questions as these:
   - What seems to be happening here?
   - What does an onion usually look like?
     ✔ Have the students make a comparison with an onion that has not started to grow roots.
   - What does a potato normally look like?
     ✔ Have the students make a comparison with a potato that has not started to grow roots.
   - How might we get the these other potatoes and onions to develop roots.

3. **Have the students plan an experiment to see how potatoes and onions develop. Have them record their observations on Student Page 2.4.13 ROOTING BULBS AND TUBERS.**

   Designs may include
   - Partially submerged bulbs and tubers in water.
     ✓ Use toothpicks stuck into the bulbs and tubers to hold them partly above the rim of the jar.
   - Completely submerged bulbs and tubers in water.
   - Bulbs and tubers kept dry.
   - Bulbs and tubers kept in a moist sack.
   - Bulbs and tubers kept in a dry sack.
   - Others.

4. **After rooting has started, ask questions and have the students discuss their experiments.**

   Ask such questions as these:
   - Under what conditions did tubers begin growing? Bulbs?
   - Under what condition do tubers not grow? Bulbs?
   - What seems to be the role of water if any?
   - What changes are you seeing?
   - How can you tell that there is a change?
   - Are your potato and onion living?
   - What evidence do you have for your statement?
   - When is a potato living? When is it dead?
   - How would you change your definition to suggest what other kinds of plant matter are living or dead?

5. **Have the students revise their working definitions of living things and plants and record their modifications in the Working Dictionary.**

EXTENSIONS

- Have the students transplant potatoes and onions into pots to see how they grow.

2.4.14 ROOTS AND WATER

OBJECTIVES

The students
- Review and observe the parts of a seed.
- Review and observe the germination of seed.
- Grow plants in a container so that the path of the roots can be observed.
- Experiment with the growth of roots.

BACKGROUND

This activity uses a seed-growing chamber that allows observation of the growing root system. See Figure 2.4.14(1). Here the students test the hypothesis that roots will seek water as they grow.

While other students are working with rooting plant parts, have the students who have not observed the growth of seeds in earlier DASH classes test the idea that roots and other plant parts emerge from seeds. This will be a review investigation for those who previously watched seeds grow.

Roots Following Water

Roots seek water. In ROOTS AND WATER after observing the normal path of root growth, their water seeking tendency is used to lead roots on a path designed by the students. The students are challenged to investigate whether roots will travel diagonally, sideways, or even up. Paper toweling has great capacity to act as a water wick and can provide a wet path in different directions for root growth.

Seed

Use bean seed or other small seeds from a commercial package. The information on the package will tell the students something about the usual way these seeds are planted and tended.

Sanitation

Sanitation is important. To prevent mold contamination, hands should be washed at all stages when handling the seeds. If seeds are in previously-opened package kill any mold spores by dipping the seeds in a

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dilute solution of bleach (5 mL of bleach in 250 mL of water or 1 tablespoon of bleach in a cup of water). Then rinse them thoroughly in tap water. Washed seeds should be soaked overnight in fresh water before planting.

Preliminary Study of Seeds
As a preliminary study students can open a soaked bean seed, observe, and then draw it. Lima beans are excellent for this preliminary study. Notice the *testa*, the coat or skin of the seed, the large white storage mass or *cotyledon*, the embryonic root or *hypocotol*, and the embryonic leaf or *plumule*. Scientific names are not necessary to understanding seeds. Descriptive labels (seed coat, baby root and baby leaf, or other) can be added to the drawing of the seed after the parts grow into their more recognizable structures.

Measuring Growth of Plant Parts
To measure and record the length of plant parts, use a wet string stuck to the outside of the cup to measure twisted or curved roots and stems. Continue the observations until there is a distinctive root, stem, and leaf. Dig up the plant in the soil for comparison, noting the downward growth of the roots.

Timing
When there is a distinctive root and stem from the seeds in the review investigation, set up the roots and water seeking investigation of this activity.

STUDENT ROLES

Horticulturist
Botanist

MATERIALS

radish, bird seeds, mung beans, or other small seeds
lima bean seed if the preliminary seed investigation is done
magnifing lenses
clear, flexible plastic cups
Styrofoam cups may be used for the inside cup
paper toweling
scissors
ice pick or nail
bleach, liquid chlorine
jar for washing seed
shallow pan or tray for water

cup or pitcher to carry water
garden-quality soil
string
metric rulers
Student Page 2.4.14 ROOTS AND WATER

PRODUCTS

Growing root systems
Completed Student Pages

PROCEDURES

1. **Prepare the seed as outlined in the Background. Kill mold and soak seeds overnight. Carry out the preliminary inspection of a seed with students who have not observed the internal structure of seeds previously.**

2. **Help the review group of students assemble a double-cup growing chamber for the review investigation of seed growth. See Figure 2.4.14(1).**

   Help them
   - Punch holes in the bottoms of two clear plastic cups so water will flow in and keep the contents of the cups wet.
   - Fill one cup with moist potting soil and wrap its outside in wet paper toweling.
   - Nest the toweling-covered and dirt-filled plastic cup in the second clear plastic cup.
   - Plant 3–4 seeds in the soil.
     ✔ The package will tell how deep to plant them.
   - Put a 3-4 seeds between the toweling and the outside cup so that they can be seen.
     ✔ The toweling will act as a wick carrying water to the seed planted between the toweling and the outer cup.
   - Put the double-cup growing chamber in a tray of water.
     ✔ The water should be deep enough to make good contact with the bottom 1/4 inch of soil and the toweling.

- Add jobs to check and add water to the tray on the Responsibility Chart.

- Observe the growth of the seed and record it in diagrams each day.
  ✔ Root growth can be traced on the side of the outer plastic cup using a permanent marker.

3. **When the roots have grown, help the review-students report on their observations.**

   Ask such questions as these:
   - Where do the roots go?
   - What seems to be the role of water?
   - What do you think would happen if there was no water?

4. **Begin the root water-seeking investigation. Show a chamber in which the toweling is a 1–2 centimeter wide strip that wraps in a spiral around the inside cup. Leave a space of 2 centimeters between the spirals of toweling. Again put soil in the inside cup and plant it. This acts as a control to be sure a seed will grow under more normal conditions. See Figure 2.4.14(2).**

   Ask such questions as these:
   - What do you think will happen if you grow seeds in a chamber where the paper toweling does not come straight up from the water?
   - Will the roots grow across the dry plastic?
   - What other questions do you have about roots and water?
     ✔ Some possible questions include: Will roots grow up as well as down? A wick can be made that will carry water either up or down. Will roots go around an obstacle? After a seed starts to grow will it continue to grow if you don't give it water?

5. **Help the student groups set up their own experiments. Have them make observations and record them on Student Page 2.4.14 ROOTS AND WATER.**

6. **Discuss the students' experiments and results.**

   Ask such questions as these:
   - Did your predictions work out?

- If they did not work out, can you think of a reason why the roots acted as they did?
- What do roots seem to do for plants?
- What evidence do you have that plants need water?
- Do roots seem to be able to follow a path in which there is water?
- What do roots do when they find an obstacle?
- Can roots grow up as well as down?

ILLUSTRATIONS

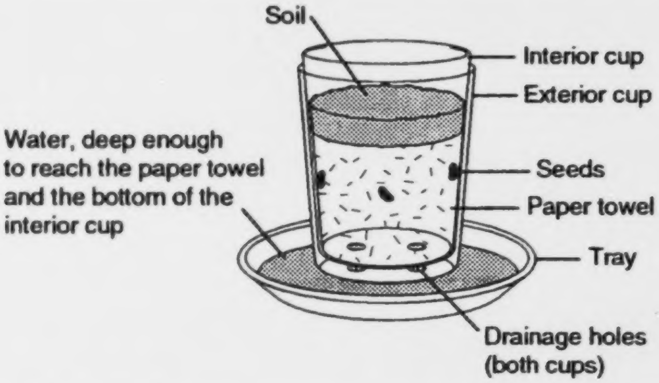
Soil
Interior cup
Exterior cup
Water, deep enough to reach the paper towel and the bottom of the interior cup
Seeds
Paper towel
Tray
Drainage holes (both cups)

Figure 2.4.14(1) Double-cup growing chamber.

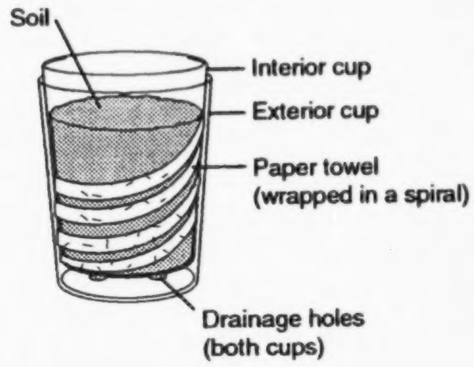
Soil
Interior cup
Exterior cup
Paper towel
(wrapped in a spiral)
Drainage holes
(both cups)

Figure 2.4.14(2) Growing chamber with a spiral paper towel.

2.4.15 GROWING ROOT VEGETABLES

OBJECTIVES

The students
- Grow various root vegetables observing that they are enlarged taproots.
- Construct a growth chamber.
- Contrast taproot growth with the root growth of mung beans.

BACKGROUND

In this activity the students observe that root vegetables are enlarged taproots. These taproots are underground food storage for plants. They contrast this with the functions of the roots of beans.

Materials
The students use the same type of growing chamber they made in Activity 2.4.14, ROOTS AND WATER with one change. They use a Styrofoam cup as the interior cup. A Styrofoam cup is more flexible than a plastic cup. The clear plastic cup should fit over the Styrofoam cup. The students use the same sanitation and planting procedures described in Activity 2.4.14 ROOTS AND WATER. Radishes are good root plants to observe.

STUDENT ROLES

Horticulturist
Botanist

MATERIALS

radish, turnip, carrot, or other root-vegetable seeds
mung or other bean seeds
clear plastic cups
Styrofoam cups
ice pick or nail to make holes in cups.
paper towels
masking tape to label chambers
waterproof pen

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scissors
bleach
jar for washing seeds
shallow pan or tray for water
soil
string
metric rulers
Connections Book
Student Page 2.4.15 GROWING ROOT VEGETABLES

PRODUCTS

Roots in growing chambers
Completed Student Pages

PROCEDURES

1. **Introduce the activity with a discussion of root vegetables.**

   Ask such questions as these:
   - Can you think of some plant roots that are vegetables?
   - How do you think a carrot or radish root grows?
   - When do you think it starts to swell?
   - How could you watch a root vegetable grow?

2. **Help the students construct, plant, and label their growing chambers.**

   Have them
   - Use a soft Styrofoam inner cup.
   - Plant root vegetables seeds such as radish, turnip, carrot, or others between the paper towel and the clear exterior cup as well as in the soil.
   - Plant mung or other bean seeds to be used for comparison if not observed in Activity 2.4.14 ROOTS AND WATER.

3. **Have the students observe the growth and keep measurements on Student Page 2.4.15 GROWING ROOT VEGETABLES.**

- Root growth can be traced on the outside of the cup with permanent markers.
- Drawings can be dated and color coded.

4. **Discuss the students' observations.**

Summarize the activity with such questions as

- How did the seeds start to grow?
- Did they grow the same way as long as you were able to observe them?
- How did they grow compared to the beans?
- Was there any difference in how fast the roots grew?
- When did the roots start to swell?

4. **Summarize the study of roots and plants. Record the students' ideas in the Connections Book.**

Ask such questions as these:

- Why is it important to learn about plants and their roots?
- How might you use what you have learned?
- Who else needs to know about plants and their roots?

EXTENSION

- Have the students observe the growth characteristics of other root vegetables.

2.4.16 TREE PLANTING

OBJECTIVES

The students
- Plant a tree with a DASH 5 class.
- Discuss Arbor Day or Earth Day.
- Observe a tree mature over time.
- Identify trees as a renewable resource.

BACKGROUND

In this activity DASH 5 students plant a pine tree with DASH 2 students to replace the one that the DASH 5 students have harvested. This newly planted tree will be harvested three years later before the December holidays by these same DASH 2 students when they are in DASH 5. The planting of the pine tree symbolizes the passing on of a heritage to another class and replenishes a resource that has been used.

Coordination

This activity should be coordinated between DASH 2 and DASH 5 classes. An ideal time for the planting of the tree is Arbor Day or Earth Day. Arbor Day usually occurs on the last Friday of April. The tree can be purchased, but preferably it is grown from seeds by the DASH 5 students. The older DASH 5 students should invite the DASH 2 students to participate in the planting. Ceremonial speeches can be given by representatives of each class. A time capsule can be buried near the tree and refreshments can be served.

Records

Students record the height of the tree and make a shadow profile of it on chart paper. The shadow profile can be drawn in the classroom before the tree is taken outside. It is suggested that information on the height and shadow profile be kept in the library to use for comparison when the tree is harvested in three years. If there is no DASH 5 program, the DASH 2 students should plant a tree on their own and harvest it when they become DASH 5 students. Individual student records are kept in their Science Record Books.

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STUDENT ROLES

Tree planter
Forester

MATERIALS

tree
shovels
chart paper
Student Page 2.4.16 HISTORY OF A TREE

PRODUCTS

Shadow profile of a tree
Completed Student Pages

PROCEDURES

1. **An invitation should be received from a DASH 5 class to attend an Arbor Day or Earth Day tree planting.**

   Ask such questions as these:
   - What is Arbor Day or Earth Day?
   - How did this day originate?
   - Why is this day important?
   - Why do you think DASH 5 students are planting a tree for us?
   - What is meant by a renewable resource?
     ✔ This is a question that can be asked of the DASH 5 representatives.

2. **Have the students plan for the Arbor Day or Earth Day ceremony.**

   Help them
   - Write a response to the DASH 5 class.
   - Plan for a thank-you speech, refreshments, and so forth.
   - Practice drawing a shadow profile.
     ✔ See Figure 2.4.16.

3. Have the class participate in the Arbor Day or Earth Day ceremony.

Have the students

- Draw a shadow profile of the tree to be planted.
- Measure and record the height of the tree on Student Page 2.4.16 HISTORY OF A TREE.
  ✔ This student page should be kept in the materials passed on to DASH 3 teachers.
- File the shadow profile and height measurement in the library for comparison in DASH 5 when the tree is harvested.
- Give a thank-you speech to the DASH 5 Students.

ILLUSTRATION

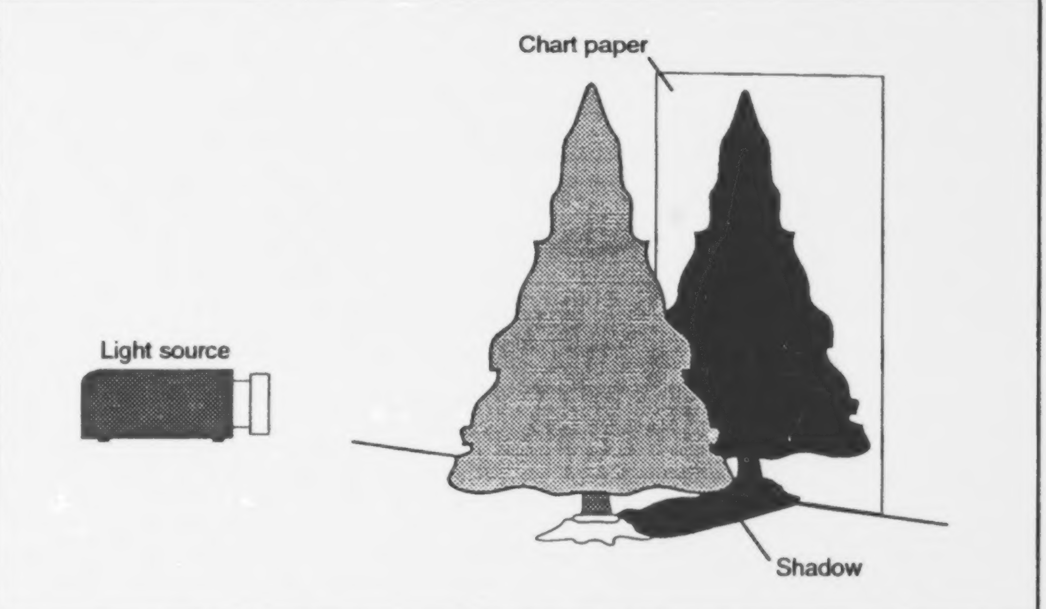

Figure 2.4.16 Shadow profile of a tree.

DASH

SOIL
SP 2.4.1

Name: ____________________

Date: ____________________

Where did you get your soil?

Observations:

MASS

Unit ________

Total Sample	Biggest	Medium Big	Medium Small	Smallest

VOLUME

Unit ________

Total Sample	Biggest	Medium Big	Medium Small	Smallest

MAKING SOIL
SP 2.4.2

Name: ____________________

Date: ____________________

SOIL RECIPE		
INGREDIENT	AMOUNT	UNIT

SOIL	MASS/WEIGHT Unit:	VOLUME Unit:
Biggest Pieces		
Medium Big		
Medium Smalll		
Smallest Pieces		

SP 2.4.3

DASH

SOIL AND PLANTS
SP 2.4.3

Name: ______________________

Date: ______________________

Kind of plant:

Kind of soil:

Date planted:

DATE	HEIGHT(cm)	OBSERVATIONS

SOIL USES
SP 2.4.4

Name: ____________________

Date: ____________________

USE								
WHERE								
DATE								

DASH

SOIL SAMPLE REPORT
SP 2.4.5

Name: ______________________

Date: ______________________

Describe your sample.

When and from where did you collect it?

Describe your soil test.

DATE	OBSERVATIONS

Describe your results.

DASH

PIPES AND WATER
SP 2.4.6

Name: ______________________

Date: ______________________

Draw and label your home water system.

DASH

MOVING WATER SP 2.4.7

Name: ____________________

Date: ____________________

Group:

Problem: ____________________

Show how you solved the problem.

DASH

MOVING WATER WITH PUMPS
SP 2.4.8

Name: ______________________

Date: ______________________

Group:
Problem: ______________________
Show your solution to the problem.

DASH

VEGETABLE GARDEN IN A BUCKET
SP 2.4.9

Name: ____________________

Date: ____________________

Vegetable:	
Date Planted:	Location:

DATE	OBSERVATIONS

DASH

FLOWER GARDEN IN A BUCKET
SP 2.4.10

Name: ______________________

Date: ______________________

Flower:	
Date Planted:	Location:

DATE	CARE	OBSERVATIONS

SP 2.4.11A

DASH

PLANT EXPERIMENT PLAN
SP 2.4.11A

Name: ____________________

Date: ____________________

Kind of plant:

Problem: ____________________

Plan: ____________________

Draw and label a picture to show how your experiment works.	Predictions:

DASH

PLANT CARE AND OBSERVATIONS SP 2.4.11B

Name: ____________________

Date: ____________________

DATE	CARE	OBSERVATIONS

DASH

ROOTS AND STEMS
SP 2.4.12

Name: ______________________________

Date: ______________________________

Kind of stem:

DATE	CARE AND OBSERVATIONS

DASH

ROOTING BULBS AND TUBERS
SP 2.4.13

Name: ______________________

Date: ______________________

Plant part:
Describe or draw your experiment.

DATE	CARE AND OBSERVATIONS

DASH

ROOTS AND WATER
SP 2.4.14

Name: ____________________

Date: ____________________

Draw and label a picture of your experiment.

Write your predictions.

DATE	OBSERVATIONS

GROWING ROOT VEGETABLES
SP 2.4.15

Name: ____________________

Date: ____________________

Root vegetable:

DATE	ROOT LENGTH (cm)	OBSERVATIONS

HISTORY OF A TREE
SP 2.4.16

Name: ______

Date: ______

Kind of tree:	
Date planted:	Location:

DATE	HEIGHT (cm)	OBSERVATIONS

DASH

GRADE 2
CLUSTER 5

Food and Nutrition

2.5.1 Supermarket Survey

2.5.2 Food Preferences

2.5.3 Basic Three Food Groups

2.5.4 New Foods

2.5.5 Identifying Properties of Vegetables

2.5.6 Changing Flavor

2.5.7 Milk

2.5.8 Butter

2.5.9 Cheese

2.5.10 Energy from Food

GRADE 2
ACTIVITY GOALS

CLUSTER 5
Food and Nutrition

2.5.1 Supermarket Survey

To continue the identification of different foods; to research where foods are grown; to research what foods can be grown locally; and to develop observation, reference research, and recording skills.

2.5.2 Food Preferences

To survey and graph food preferences; to compare self with others; to develop observation, graphing, reflecting, and recording skills.

2.5.3 Basic Three Food Groups

To explore the Basic 3 food function system for categorizing food; to associate nutrients with food categories; to learn mnemonics to recall food categories; and to develop listening, classifying, reasoning, and reflecting, skills.

2.5.4 New Foods

To expand the kinds of foods that are liked or tolerated and to develop observation, reflecting, and recording skills.

2.5.5 Identifying Properties of Vegetables

To explore how food is identified by taste; to develop ways of describing food tastes; and to develop observation, classifying, and recording skills.

2.5.6 Changing Flavor

To explore ways the taste of food can be changed; to expand the range of foods eaten by changing the taste of foods; to develop ways to reduce food waste in the cafeteria; and to develop observation, reasoning, and recording skills.

2.5.7 Milk

To explore components in unhomogenized milk; to make homogenized milk; to identify cream and milk by taste; and to develop observation and recording skills.

2.5.8 Butter

To observe separation of cream and milk in unhomogenized milk; observe the separation of butter and buttermilk from cream; to generalize that milk is composed of different components; and to develop observation, reasoning, and recording skills.

2.5.9 Cheese

To observe separation of cream and skim milk; to make cheese from skim milk; to reinforce the generalization that some foods are composed of different components; and to develop observation, reasoning, and recording skills.

2.5.10 Energy from Food

To review definition of energy as a heat source; to experiment with burning food to get heat; to generalize about foods having many components and functions; and to develop observation, reasoning, and recording skills.

DASH

2.5.1 SUPERMARKET SURVEY

OBJECTIVES

The students
- Identify common supermarket vegetables and fruits.
- Find out and map where fruits and vegetables are grown.
- Find out what fruits and vegetables can be grown locally.
- Find out when various fruits and vegetables can be grown locally.

BACKGROUND

This activity is the first in a series on fruits, vegetables, and salads. It builds on work begun in the DASH 1. It should be followed by Activities 2.5.2 FOOD PREFERENCES, 2.5.3 BASIC THREE FOOD GROUPS, 2.5.4 NEW FOODS, 2.5.5 IDENTIFYING PROPERTIES OF VEGETABLES, and 2 5.6 CHANGING FLAVOR

SUPERMARKET SURVEY is best done in winter before vegetables and fruits are in season locally. In this activity the students make a survey of their local store or supermarket to find out what fruits and vegetables are being sold and where they are grown. They identify fruits and vegetables that cannot be grown locally. The students then use information on seed packets to determine when fruits and vegetables can be grown and harvested locally. They contrast seasonal growth information with what they know about in-class bucket gardening and make hypotheses as to why vegetables and fruits are seasonal.

Approach

The supermarket survey can be carried out as a home assignment or as a field trip. If the home assignment approach is used, a letter to parents should be sent to explain what is needed. A local store will often agree to respond to the students' questions. Such a store should be identified in the letter home. Information may be specially posted in the store for the students and families to read or a store employee may be designated to help answer questions.

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If the field trip approach is used, planning needs to be done with parents or others who will accompany the class as well as with store personnel. Ideally, the students will be in groups of 4 or 5 to one adult. Store personnel can answer questions either at the site or at the school later.

STUDENT ROLES

Survey taker
Theorist

MATERIALS

seed packets
map of the world
Student Page 2.5.1A SUPERMARKET SURVEY
Student Page 2.5.1B WHERE FOODS ARE GROWN

PRODUCTS

Class map about foods from other places
Completed Student Pages

PROCEDURES

1. **Make arrangements for the survey. See Background.**

2. **Introduce the activity by asking the students to make predictions about what foods will be found in the supermarket.**

   Ask such questions as these:
   - What fruits and vegetables do you think you will find in our local supermarkets now?
   - Where do you think those fruits and vegetables are grown?
   - How could you find out?

3. **Have the students use Student Page 2.5.1A SUPERMARKET SURVEY to list the fruits and vegetables they predict will be in the supermarket.**

4. **Have the students carry out the supermarket survey.**

5. **Review the survey by having the students work in small groups to complete Student Page 2.5.1A SUPERMARKET SURVEY .**

   Ask such questions as these:
   - Which of the fruits that you thought you would find did you not find?
   - Why might those fruits not have been there?
   - Which vegetables that you listed did you not find?
   - Why might they not have been there?

6. **Help the students make a produce map of the world showing where vegetables and fruits come from. Have them begin Student Page 2.5.1B WHERE ARE FOODS GROWN.**

7. **Have student groups look at seed packets and determine the season fruits and vegetables can be grown locally. Have them complete Student Page 2.5.1B WHERE ARE FOODS GROWN.**

8. **Have the students make hypotheses about seasons and the growing of fruits and vegetables.**

   Ask such questions as these:
   - What do you think the places are like where (name a vegetable not locally in season) is now growing?
   - Have you been able to grow any of the vegetables in our bucket gardens that are not grown in local outdoor gardens now?
   - Why do you think you can grow plants in the classroom when farmers and gardeners can not grow them locally?
   - What is it like outdoors when these vegetables and fruits are grown locally?
   - What is your hypothesis to explain why plants will grow only in certain seasons?

EXTENSION

- Have the students make a comparative survey of fruits and vegetables in supermarkets later on in the year.

2.5.2 FOOD PREFERENCES

OBJECTIVES

The students
- Make a list of foods that they like and dislike.
- Determine how many others agree with their likes and dislikes.

BACKGROUND

This activity is part of a series designed to begin to encourage students to eat a wider variety of foods. Others in the series are 2.5.3 BASIC-THREE FOOD GROUPS and 2.5.4 NEW FOODS.

Food Waste

Food waste studies in federally subsidized school lunch programs show that salads, cooked vegetables, and milk are the most common plate-waste items on students' trays. This presents a problem because much of the vitamin and mineral content of the school lunch is supplied by these foods. These school plate-waste studies have been verified in similar home studies. Because good nutrition involves eating a wide variety of foods, what is started here is a campaign to get students to eat some or all of the salads, cooked vegetables, and milk in their school lunch and move toward the point where they begin to tolerate or like these items.

School Lunch Program

FOOD PREFERENCES is built around the standard federally sponsored school lunch program. However, in schools with no such program students who bring a home lunch may readily use the same sequence because studies show that vegetables, salad materials, and milk are also the items most thrown away from home lunches.

Request a copy of the school menu for a month from the school food service manager.

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STUDENT ROLE

Survey maker

MATERIALS

school lunch menus
chart paper
1-inch graph paper
markers
Student Page 2.5.2 FOOD PREFERENCES

PRODUCTS

Graph of foods liked and disliked
Completed Student Pages

PROCEDURES

1. **Introduce the activity by discussing the school lunch menu for the week.**

   Ask such questions as these:
   - How many like all the foods on this week's lunch menu?
   - Are there foods that you like better than others?

2. **Have the students work in small groups to list the two foods that appear on the school menu that they like the best and the two they like the least.**

3. **Have students make a class graph of the foods most liked and foods liked the least. Have them use different colors to indicate the most-liked and least-liked foods.**

4. **Have the students record on Student Page 2.5.2 FOOD PREFERENCES two other foods, not on the menu, that they really like and two other foods they really dislike. Add these to the graph.**

5. **Discuss and review the graph with the class.**

Ask such questions as these:

- Why do you think some people like some foods and other people seem to like other foods?
- How do you think people get to like different foods?
- Have you ever had foods that you did not like when you first ate them but later learned to like?
- How did you learn to like the food?
  ✔ List the ways students learned to like foods.
- What do you think might happen if you do not eat certain kinds of foods, like milk or milk substitutes, vegetables, fruits, or salads?

EXTENSIONS

- Have the students report on the number of times a week they are served foods they dislike on the school lunch menu and in their meals at home.
- Make a list of ways that food that is thrown away could be used.

2.5.3 BASIC–THREE FOOD GROUPS

OBJECTIVES

The students
- Review the Basic-Three food group system.
- Use a game to associate foods with each of the Basic-Three groups.
- Make an ARF Food-Function Wheel.
- Identify simple and compound foods represented in the ARF Food-Function Wheel.
- Develop a working definition of the term *nutrient* to refer to things in foods that are needed for activation, regulation, and fabrication.

BACKGROUND

Nutrition is an ongoing theme in DASH. Ideas introduced here are expanded at each succeeding grade. In DASH 1 students were introduced to the Basic-Three food grouping system. This system associates foods with their functions in the body. The three basic functions are *fabricating* or building and repairing the body, *regulating* or controlling body operations and causing it to run right, and *activating* or making the body move.

Approach

The students use a Basic-Three rhyme and/or song to review the idea of the three food-function groups—*activation (A)*, *regulation (R)*, and *fabrication (F)*. They then make cards and play a game to help them associate basic foods with their function. This is followed by the construction of an ARF Food-Function Wheel showing the different groups of foods. See Figure 2.5.3(1). Using a mnemonic, the students are helped to develop the idea that a wide variety of foods from each food group needs to be eaten each day. Finally, they are introduced to the idea that nutrients are components of foods and they develop a working definition of the term *nutrients*.

Ideally, the series of activities on the components of milk will be done shortly after BASIC–THREE FOOD GROUPS. Activities 2.5.7 MILK, 2.5.8 BUTTER, and 2.5.9 CHEESE reinforce the idea that foods are made up of multiple components.

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Simple and compound foods

The basic foods are simple foods that fit in only one of the food-function groups, for example fruits, vegetables, meat, and so forth. In the first part of the activity the students make Basic-Three food group function cards. Cards have pictures, food names, and functions on them. See Figure 2.5.3(1) ARF Food-Function Wheel.

Most common foods that students eat are *compound foods* containing foods from two or all three basic groups. This creates four additional groups of food—*activation–regulation (AR)*, *activation–fabrication (AF)*, *regulation-fabrication (RF)*, and *activation-regulation-fabrication (ARF)*. These compound groups are also shown on the ARF Food-Function Wheel. Additional food-function cards are be made to identify these compound foods.

Color Coding

Visual imagery can be used to help recall the groups of the ARF Food-Function Wheel. Segments of its pie structure can be color coded. There is an added art lesson here in the mixing of color.

(A) *activation* (breads, cereals, sugar, and fats) = Yellow
(R) *regulation* (fruits and vegetables) = Blue
(F) *fabrication* (red meat, fish, poultry, and milk) = Red
(AR) *activation–regulation,* = Green
(AF) *activation–fabrication* = Orange
(RF) *regulation-fabrication* = Purple
(ARF) *activation-regulation-fabrication* = Brown

Nutrients

At this point in the students' concept development it will be sufficient for them to conclude that *nutrients* are the things in foods that our bodies need for *activation, regulation,* and *fabrication* and that the nutrients are released from foods in digestion. The idea of foods being made of several things will be developed further in the break up of milk to produce, cream, butter, and cheese in Activities 2.5.7 MILK, 2.5.8 BUTTER, and 2.5.9 CHEESE.

Nutrients the students will come to know in DASH 4 are *carbohydrates* (sugars and starches) and *fats* which are the dominant contributors to foods in the *activation* group; *vitamins* and *minerals*, the dominant contributors to foods in the *regulation* group; and *proteins* the dominant contributor of foods to the *fabrication* group.

USDA Pyramid System

The pyramid system of the U.S. Department of Agriculture (USDA) divides each of the food-function groups in the Basic-Three system into two sub-food groups. *Fabrication* foods are divided into a *dairy products* group and a *fish, poultry, and red meat* group. *Regulation* foods are divided into a *fruit* group and a *vegetable* group, and the *activation* foods into a *sugar and fat* group and a *bread and cereal* group. As can be seen similarities in the two systems makes the later transition to the USDA system in DASH 4 quite easy. See figure 2.3.5(2).

There are disadvantages in using the food pyramid that are overcome by the ARF Food-Function Wheel. First, in the pyramid system there is no indication of the functions of foods. Second, the pyramid system does not account for common compound foods that make up much of our diet. Conceptually these deficiencies of the pyramid present difficulties especially for young students and we strongly recommend that the ARF Food-Function Wheel be used in the early grades.

STUDENT ROLE

Nutritionist

MATERIALS

Basic-Three Food Group Rhyme
Basic-Three Food Group Song
Food Variety Aphorism
scissors
glue
magazines with food pictures
newspapers with food ads
3 x 5 cards
Student Page 2.5.3 ARF FOOD-FUNCTION WHEEL

PRODUCTS

Food-Function Cards
Class ARF Food-Function Wheel
Completed Student Pages

PROCEDURES

1. **Introduce the activity using the Basic-Three Food-Function Rhyme, the Basic-Three Food-Function Song, or both.**

Basic-Three Food-Function Rhyme

Grains and butter, a sesame seed roll,
Potato and sugar, cereal in a bowl,
These are foods for ACTIVATION.

For crawling and climbing, getting all hot,
For running and jumping, turning on a dot,
Moving our body, that's ACTIVATION.

Spinach and cauliflower, corn on the cob,
Apples and oranges, pureed peaches in a glob,
These are foods for REGULATION.

For digesting and defending, arranging things inside,
For seeing and thinking, directing what's supplied,
Controlling our body, that's REGULATION.

Steak and beans, roasted chicken legs,
Milk and codfish, ham served with eggs,
These are foods for FABRICATION.

For building, maintaining, making muscles strong,
For repairing, growing, and making bone that's long,
Building our body, that's FABRICATION.

293

Basic-Three Food-Function Song*

Activation, foods for moving,
Body motion, locomotion.
Potatoes, rice, and shredded wheat,
Butter, bread, and candy sweet,
Activation foods,
Activation foods.

Regulation for controlling,
Body control is food's role.
Spinach, peas, and cauliflower,
Apples, berries, lemons sour,
Regulation foods,
Regulation foods.

Fabrication, foods for growing,
Body care, growth and repair.
Beans and chops, and turkey legs,
Milk and fish, and steak and eggs,
Fabrication foods,
Fabrication foods.

* Sung to *Are You Sleeping Brother John*

Ask such questions as these:

- What does the rhyme or song tell you *activation* foods do for your body?
  ✔ Repeat the activation stanzas. Work to the idea that activation foods make the body move.

- What does the rhyme or song tell you *regulation* foods do for your body?
  ✔ Repeat the regulation stanzas. Work to the idea that regulation foods control the way the body works in the sense of operating or functioning.

- What does the rhyme or song tell you *fabrication* foods do for your body?
  ✔ Repeat again the fabrication stanzas. Work to the idea that fabrication foods build and repair the body.

2. **Have the students work in teams to cut out pictures of foods from magazines and newspaper food ads that belong to each of the three basic food-function groups. Have them paste each picture on a 3 x 5 card. Help them write the food-function group and the name of the food on the back of the card.**

Have the student teams

- Repeat the activation stanzas. Then cut out activation foods.
  ✔ Discuss other activation foods.
  ✔ Have each team make 3-4 cards.
  ✔ Write *activation* and the name of the food on the back.

- Repeat the regulation stanzas. Then cut out regulation foods.
  ✔ Discuss other regulation foods.
  ✔ Have each team make 3-4 cards.
  ✔ Write *regulation* and the name of the food on the back.

- Repeat the fabrication stanzas. Then cut out fabrication foods.
  ✔ Discuss other fabrication foods.
  ✔ Have each team make 3-4 cards.
  ✔ Write *fabrication* and the name of the food on the back.

- Assemble their cards into a deck of 9-12 cards.

3. **Have the student teams exchange card decks and play the Food-Function Card Game.**

Food-Function Card Game

Rules:

- Shuffle the cards.
- Place the deck on the table with the food pictures up.
- The first player must tell the name of the food and the food-function group.
- If the answer is correct, the player keeps the card.
- If the answer is wrong, the card goes to the bottom of the deck.
- Each succeeding player follows the same procedure until all of the cards are gone.
- The student with the most cards wins.

4. **Help students construct a large class ARF Food-Function Wheel. Prepare the wheel ahead of time. See figure 2.5.3(1). The wheel should be at least 3 feet in diameter to accommodate all the cards.**

Have the students

- Put one food card from each team's game set in each *basic* food segment of the wheel.
  ✔ Each team should add a different food.
- Write the name of their food on their own wheel on Student Page 2.5.3. ARF FOOD-FUNCTION WHEEL.

5. **Help the students identify some compound (mixed) foods. Have them work in teams to cut out pictures of foods from magazines and newspaper food ads that belong to the four compound food-function groups. Have them paste these on 3 x 5 cards. Help them write the food-function group and the name of the food on the back.**

- Have the students observe overlaps between the basic food sections on the ARF Food-Function Wheel.
  ✔ Work to the idea that these sections contain compound foods that are made up of foods from the basic groups on either side.

- Ask for examples of compound foods containing a basic *activation* and a basic *fabrication* food.
  ✔ Examples might be a hot dog on a bun, melted cheese on toast, or an egg on a muffin.

- Have the students cut out or draw foods containing a basic *activation* and a basic *fabrication* food.
  ✔ Have each team make 3 cards for the *AF* group.
  ✔ Help them write the name of the food and the food-function group on the back of each card.

- Have the student cut out or draw foods containing a basic *regulation* and a basic *fabrication* food.
  ✔ Examples might be beef and vegetable soup or cauliflower with cheese sauce.
  ✔ Follow steps above for making game cards.

- Ask for examples of compound foods containing a basic *activation* and a basic *regulation* food.
  ✔ Examples might be a lettuce and tomato sandwich, a fruit pie, or jam on toast.
  ✔ Follow steps above for making game cards.

- Ask for examples of compound foods containing all three basic groups—*activation*, *regulation*, and *fabrication*.
  ✔ Examples might be a vegetarian pizza with cheese, hamburger with lettuce and tomato, or a chicken pot pie.
  ✔ Follow steps above in making game cards.

- Have the teams put one food card from each of their compound groups on the class ARF Food-Function Wheel.

- Have each student write the name of their team's food on their own wheel on Student Page 2.5.3. ARF FOOD-FUNCTION WHEEL.

- Have the teams add their remaining compound food group cards to their deck of basic-three food group cards.

- Have the student teams exchange card decks and again play the Food-Function Card Game using all the food group cards.

6. **Use the mnemonic below to reinforce the idea of eating a wide variety of food each day containing foods from the Basic-Three foods groups.**

Food Variety
Aphorism

Nutrition needs we meet,
Every time we eat
From the Basic-Three
In wide variety.

Ask the students such questions as:

- What is meant by a wide variety?
  ✔ Get at the idea that there are many different foods that can provide selections from the three basic foods groups—*activation, regulation*, and *fabrication*. One should eat different kinds of foods from each group.
  ✔ Extend this idea to include compound foods.

- Why would you want to eat a wide variety of foods?
  ✔ Work to the idea that different foods have different things that our bodies need.

7. **Introduce the idea of *nutrients* as the things in foods that bodies use for *activation, regulation* and *fabrication*.**

Ask such questions as these:

- What do you feed the class pets? What do pets need for healthy bodies?
  ✔ Get at the idea they feed the pets foods and water.

- What do the pets pass out of their bodies body?
  ✔ Get at the idea that what goes in as food and water comes out as feces and urine.

- What seems to happen to food in the animals body?
  ✔ Get at the idea that it is changed into feces.

- What do you call the way the body processes or breaks down food in your body that you ate?
  ✔ Work for the word *digestion.*
  ✔ Have the students recall where they have heard the word digestion such as in commercials for upset stomachs.

- We say that we eat food for *activation, regulation,* and *fabrication.* What do you think digestion does for the body?
  ✔ Work at the idea that it must get out of food what the body needs for *activation, regulation,* and *fabrication.*

- Does anyone know what we call the things digestion gets out of food that our bodies need for *activation, regulation,* and *fabrication*? What is it?
  ✔ Supply the word *nutrients* if the students do not know it.

- Discuss that *activation* nutrients come from *activation* foods, *regulation* nutrients come from *regulation* foods, and *fabrication* nutrients come from *fabrication* foods.

- Does anyone know examples of nutrients? What are they?
  ✔ If yes ask how they might be used by bodies.

- How would you define *nutrients*?
  ✔ Make an entry in the Working Dictionary such as *nutrients* are the things gotten out of foods by digestion that the body uses for activation, regulation, and fabrication.

EXTENSION

- Have students construct a Basic-Three Bulletin Board. See Figure 2.5.3(1) ARF Food-function Wheel.

ILLUSTRATIONS

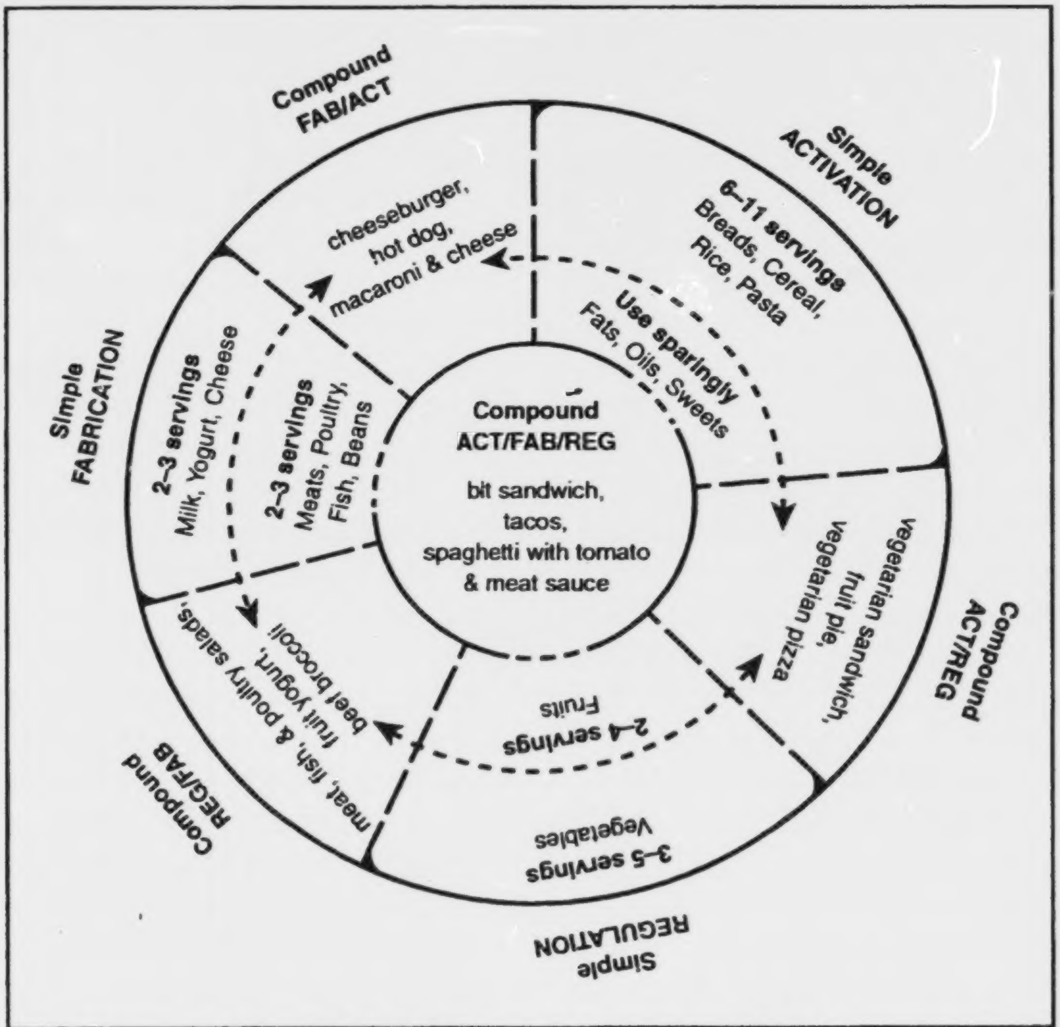
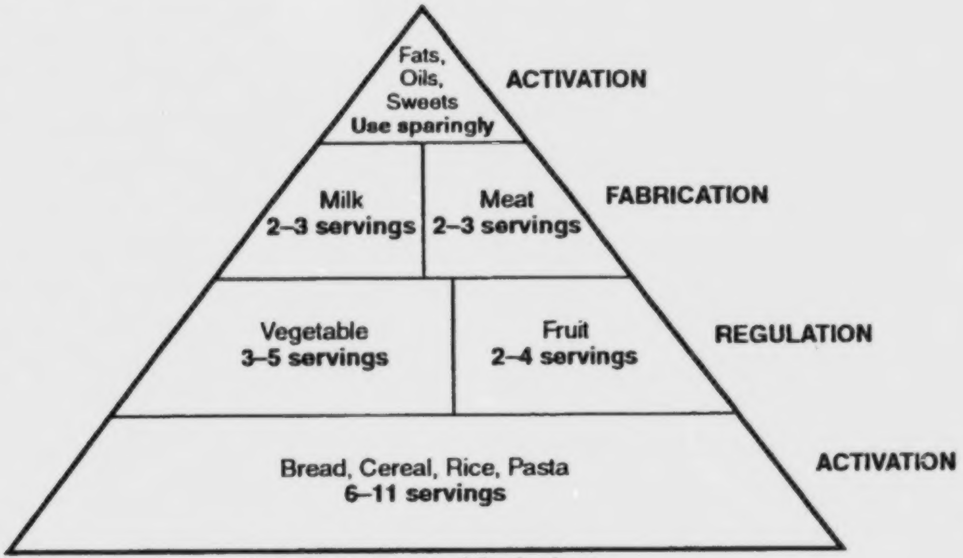

Compound FAB/ACT
cheeseburger, hot dog, macaroni & cheese
Simple ACTIVATION
6–11 servings Breads, Cereal, Rice, Pasta
Use sparingly Fats, Oils, Sweets
Compound ACT/FAB/REG
bit sandwich, tacos, spaghetti with tomato & meat sauce
Compound ACT/REG
vegetarian sandwich, fruit pie, vegetarian pizza
2–4 servings Fruits
3–5 servings Vegetables
Simple REGULATION
Compound REG/FAB
meat, fish, & poultry salads, fruit yogurt, beef broccoli
Simple FABRICATION
2–3 servings Milk, Yogurt, Cheese
2–3 servings Meats, Poultry, Fish, Beans

Figure 2.5.3(1) ARF Food-Function Wheel.


Fats,
Oils,
Sweets
Use sparingly
ACTIVATION
Milk
2–3 servings
Meat
2–3 servings
FABRICATION
Vegetable
3–5 servings
Fruit
2–4 servings
REGULATION
Bread, Cereal, Rice, Pasta
6–11 servings
ACTIVATION

U.S. Department of Agriculture
Daily Food Choices

figure 2.5.3(2) USDA Food Pyramid.

2.5.4 NEW FOODS

OBJECTIVES

The students

- Identify foods that they do not like or usually don't eat from the school lunch or their home lunch.
- Agree to try a sampling of disliked foods each time they are served.
- Record, for a set period of time, how much of a serving they eat each time a disliked food is presented.
- Report how well they like the food at the end of the period.

BACKGROUND

Here *new foods* refers to foods that are new to the student's normal list of foods eaten at school and home. The major goal of a successful nutrition education program is to have students follow healthy food eating practices when they complete their studies. One of the most important things in achieving good nutrition is eating a wide variety of foods. The objective here is to help the students learn to like or at least tolerate many different foods. Most important in this process is learning that food behavior can change.

Be sure to check to find out whether any students have a lactose intolerance, a common problem, have other food allergies, are on special diets, or are vegetarians. The way these students eat will be different from other students. By second grade most students will be able to provide this information. These special students need not engage in all parts of this activity.

STUDENT ROLE

Nutritionist

MATERIALS

school lunch menus
Student Page 2.5.4 NEW FOODS

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PRODUCTS

Completed Student Pages

PROCEDURES

1. **Introduce this activity with a class discussion on the need to eat a variety of foods.**

   Ask such questions as these:
   - Why is it important to eat a wide variety of foods from each food group?
   - How might you increase the number of different foods you eat from each food group?
   - Do you find foods from any food group on the school lunch menu that you do not like?

2. **Review Student Page 2.5.2 FOOD PREFERENCES and have students identify 1–3 foods they do not particularly like from the school lunch or their home lunch that they would be willing to try to learn to like. Record these on Student Page 2.5.4 NEW FOODS.**

3. **Help the students learn how to use a recording system in which they keep track of the amount of a food they eat each time the item is served.**

   - This might be a spoonful, fork full, or part of a serving.
     ✔ This could be a 1/2, 1/4, 1/8 of a serving.

4. **Have the students start the trial eating period of 3–4 weeks. Regularly remind students to record their progress.**

   Ask such questions as these:
   - Were any of the items on your list served today?
   - Have you recorded what you ate?

5. **At the end of the trial period have the students record how they now feel about the foods on their list.**

Ask such questions as these:

- Have any of you changed the way you feel about eating one or more of the foods on your list?
  ✔ Take a count.
- Why do you think you changed the way you feel about eating one or more of the foods on your list?
- Have any of you not changed the way you feel about eating one or more of the foods on your list?
  ✔ Take a count.
- Why do you think you have not changed the way you feel about eating one or more of the foods on your list?
- Why should you regularly try a food if you want to learn to eat it?
- How else might you change the way you feel about the foods you eat?

EXTENSION

- Whether progress was made or not during this activity, it will be informative to see what students' feelings are about the same foods later in the year.

2.5.5 IDENTIFYING PROPERTIES OF VEGETABLES

OBJECTIVES

The students
- Play a food identification game.
- Identify foods by their flavor and other properties.
- Generalize that we use physical properties to identify things.

BACKGROUND

Different people have differing capacities to discriminate between flavors. Yet, it is usually possible for a person to compare two foods and tell whether they are alike or different. This is in part because foods have complex flavors and different people can identify at least some if not all flavor components. Other properties such as texture, degree of firmness, moisture content, and so forth, help define a food. This activity is a companion to Activity 2.5.6 CHANGING FLAVOR.

Preparation

Prior to the class session cut 6 or more different vegetables into bite-size pieces. Make 2–4 different sets of vegetable samples with three different vegetables per set, each vegetable having 2 pieces. Make one set for each child in the class. Examples:

FOOD SET 1
2 pieces of carrot
2 pieces of cauliflower
2 pieces of broccoli

FOOD SET 2
2 pieces of raw potato
2 pieces of celery
2 pieces of cucumber

FOOD SET 3
2 pieces of zucchini
2 pieces of summer squash
2 pieces of eggplant

FOOD SET 4
2 pieces of spinach
2 pieces of romaine lettuce
2 pieces of iceberg lettuce

Sources of small amounts of vegetables include grocery store salad bars and parents.

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STUDENT ROLE

Taste tester

MATERIALS

raw vegetables
blindfolds
paper plates
toothpicks
paper towels
knife
Student Page 2.5.5 IDENTIFYING FOODS

PRODUCTS

Completed Student Pages

PROCEDURES

1. **Introduce the activity by discussing properties and working definitions.**

   Ask such questions as these:
   - How can you distinguish between a dog and a cat?
   - What properties do they have that help you distinguish between them?
   - What would your working definition of a dog be?
     ✔ A dog is a kind of mammal. In form it has four legs, a tail, fur, and teeth of a carnivore. It functions as a domestic pet, is used for protection, a companion, and so forth.
   - What would your working definition of a cat be?
   - If you were blindfolded, could you distinguish between a cat and a dog? A small grapefruit and an orange? How?

2. **Have the students prepare for the game.**

   Have them
   - Wash their hands.
   - Spread toweling on the table.
   - Use Student Page 2.5.5 IDENTIFYING FOODS.
   - Work in pairs.
   - Blindfold one member of the pair.
   - Place a vegetable set on the table.
   - Remain silent during the game.

3. **Give the students directions for the game.**

   Describe the game
   - Show the seeing partners how to skewer one of the vegetables in the set with a toothpick and present it to their teammates.
   - Have the blindfolded students taste a bit of the vegetable sample, then place the uneaten part on their right side.
   - Have the seeing students present another sample of the vegetable set to their partners.
   - Have the blindfolded students place the vegetable with the one on the right if it is the same and in front of them if it is different.
   - Repeat this procedure using the three positions—right, left, and in front to sort the foods into three pairs of like foods.

4. **When blindfolded students think they have the foods paired up, have them whisper what they think each vegetable is and have their partners write the name on Student Page 2.5.5 IDENTIFYING FOODS.**

5. **Remove the blindfolds so that the students can see what they have done and record their observations.**

6. **Have the students reverse roles and repeat the process with different vegetable sets.**

7. **Review the game with the class.**

   Ask such questions as:
   - How many of you got all of the foods correctly paired?
     ✔ Record the count.

   - How many got 2 out of the 3, 1 out of the 3, or 0 out of 3 correctly paired?
     ✔ Record the counts.

   - How many of you got the name of all of the foods correct?
     ✔ Record the count.

   - How many got 2 out of the 3, 1 out of the 3, or 0 out of 3 correctly named?
     ✔ Record the counts.

   - How did you tell the foods apart?

   - How would you tell someone else what a (carrot, radish, piece of lettuce, etc.) tastes like?

   - Would anyone else describe it as like a carrot, radish, piece of lettuce, etc.?

8. **Generalize with the students about the language we use to describe flavor and the other properties that make vegetable identification possible. Point out how we use comparative language such as *it tastes like carrots, oranges, or beef.***

9. **Have the students write a descriptions of the vegetable samples they have just eaten without using names. Describe them using 1. taste, 2. texture (limp, crisp, crunchy, and so forth), and 3. visual properties.**

10. **Read the taste description of a vegetable and have the students guess what the vegetable is. Read the additional texture description and have the students guess again. Lastly read the visual description and have the students guess a third time. Give the name of the vegetable. Discuss and then repeat with other vegetables.**

    Ask such questions as
    - How many of you identified the vegetable from the taste description?
      ✔ Record the count.

- How many of you identified the vegetable from the taste and texture description?
  ✔ Record the count.

- How many of you identified the vegetable from the taste, texture, and description?
  ✔ Record the count.

- If you want to tell someone about a new vegetable, which is the best way to describe it, by appearance, by texture, or by taste or some combination?
  ✔ Get at the advantage of using appearance, texture and taste in describing foods.

EXTENSION

- Have the students try to identify groups of such things such as flowers, drinks, animals from someone's description alone. Descriptions cannot include the thing's category name. When there are a few spare minutes play a *Can You Describe It So We Know It?* game.

2.5.6 CHANGING FLAVOR

OBJECTIVES

The students
- Taste foods before and after adding garnishes.
- Report their likes and dislikes of foods before and after garnishing.
- Make generalizations about ways to learn to eat new foods.

BACKGROUND

This is a multi-purpose activity. It is designed to be used with the 2.4.9 VEGETABLE GARDEN IN A BUCKET when vegetables are harvested. In CHANGING FLAVORS the students eat harvested vegetables as snacks. They explore adding garnishes so that they increase their liking for the vegetables and fruits they have grown. CHANGING FLAVORS can also be done along with Activity 2.5.5 IDENTIFYING PROPERTIES OF VEGETABLES, so that the students observe how the taste of these vegetables can be changed.

Studies show that cafeteria plate waste can be greatly reduced by providing a selection of garnishes for the students to use with vegetables and salads.

STUDENT ROLE

Taste tester

MATERIALS

several dips or dressings
garden vegetables
paper toweling
knives
cutting board
paper plates
Student Page 2.5.6 CHANGING FLAVOR

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PRODUCTS

Vegetable snacks
Completed Student Pages

PROCEDURES

1. **Suggest to the class that since their bucket garden has produced a crop of edible vegetables and/or fruits they can eat them for snacks.**

   Ask the students such questions as:
   - How many of you have reported that you do not like salads?
   - How might you change the flavor of salads so they are more tasty?
   - Is there anyone who does not like raw vegetables?
   - How might you change the flavor of the vegetables you don't like?
   - What do you have to do to prepare vegetables for eating?

2. **Have the students prepare foods for snacking.**

   Have them
   - Wash their hands and kitchen equipment—knives, cutting boards, dishes, spoons, etc.
   - Clean the vegetables.
   - Cut, peel, and prepare the vegetables for a snack.

3. **Help the students read directions and make salad dressings and dips.**

4. **Have the students taste different garnishes (dressings and dips) and identify ones they like or dislike.**

   Have them
   - Eat small pieces of vegetables without garnishes.
   - Eat small pieces of vegetables with garnishes.

5. **Have the students report their responses on Student Page 2.5.6 CHANGING FLAVOR.**

   Ask such questions as these:
   - Why do you think people like vegetables with different garnishes?
   - Are there vegetables and fruits you did not like before but you now like or don't mind eating when they are garnished with dips or dressings?
   - How might your liking of different foods relate to your ability to identify foods by their flavor?
   - Why are dressings, dips, and sauces important in preparing foods?
   - Why is it important for everyone to eat a wide variety of vegetables?

EXTENSIONS

- Have a vegetable snack festival.
- If a selection of dressings and sauces is not offered in the cafeteria, work with the Food Service Manager to have a sauce or a dressing of the week in an attempt to get the students to broaden their tastes for vegetables and salads.

2.5.7 MILK

OBJECTIVES

The students

- Observe that cream separates out when whole unhomogenized milk stands.
- Observe that homogenized milk does not separate into layers.
- Observe that milk is made of several different components.
- Make homogenized milk from unhomogenized milk.

BACKGROUND

This activity is the first in a sequence about milk and foods produced from milk. It precedes Activities 2.5.8 BUTTER and 2.5.9 CHEESE. Ideally, the entire milk series will be done along with or shortly after Activity 2.5.3 BASIC-THREE FOOD GROUPS.

Nutrients

One of the more difficult concepts for students to grasp is that foods such as milk are composed of different components, and therefore, different nutrients. The idea of a nutrient as a component of food is introduced in 2.5.3 BASIC-THREE FOOD GROUPS. Further, in Activity 2.5.10 ENERGY FROM FOOD the students find that energy is stored in food. Energy is stored in the nutrient components carbohydrates, fats, and proteins. Carbohydrates and fats, the bodies primary source of energy, are nutrients normally associated with the *activation* food group.

Sequence

In this study of milk, the students get a sense of what is meant when one talks about food components. This supports understanding of the idea of the more abstract nutrients as being components of foods. Here the students observe cream separate out of whole milk. In Activity 2.5.8 BUTTER they make butter and buttermilk from the cream and in 2.5.9 CHEESE they make cheese from the skim milk.

Unhomogenized Whole Milk.

In some places it may be difficult to find unhomogenized or raw whole milk. Unhomogenized whole milk can be made by adding 1 cup of whipping cream to 3 cups of skim milk. Thoroughly shake and mix the

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cream and skimmed milk to make homogenized milk. Let the milk stand overnight for the separation to occur. The cream will separate and float to the top of the container.

STUDENT ROLE

Creamery technician

MATERIALS

unhomogenized whole milk or skim milk and whipping cream
homogenized whole milk
small clean clear glass or plastic containers with lids (baby food jars)
straws
aluminum foil
pitchers
plastic or newsprint to cover work areas
paper towels
Student Page 2.5.7 MILK

PRODUCTS

Separated cream and skim milk
Completed Student Pages

PROCEDURES

1. **Help the students discuss what they know about milk.**

   Ask such questions as:
   - What do you think milk is?
   - Did anyone find any water in milk last year?
     ✔ Review the test for water with cobalt chloride paper. Blue (dry) cobalt chloride paper when touched to milk turns pink—the test for water.
   - What else might be in milk?

2. **Have the students wash their hands and put down clean plastic or newspapers on their work area.**

3. **Have the students work in small groups to investigate homogenized and unhomogenized whole milk. Shake the whole milk just enough to get the cream and skimmed milk layer to mix before pouring it into the students' containers. See Background for a recipe for unhomogenized whole milk if it is not available.**

   Have the students
   - Pour whole unhomogenized milk into a small clean clear jar.
   - Pour homogenized milk into a separate, similar container.
   - Label and put lids on the two containers.

4. **Have the students observe the two containers.**

   Ask such questions as
   - Are there any differences in the two? If so, what are they?
     ✔ Look for separation of the cream.
   - What do you think the material on the top is?
   - What does it taste like?
     ✔ Have them dip a clean straw into the cream. Have them hold a finger over the end to keep the cream from flowing out of the straw. Put the cream on a piece of clean aluminum foil.
   - Does it taste like the other milk?
     ✔ Using the straw draw off other samples for comparison.
   - What do you think the material on the bottom is?
   - Can you make the homogenized and whole milk look the same? If so, how?

5. **Have students homogenize the unhomogenized milk by shaking. Let the milk stand overnight or until separation occurs.**

   Ask such questions as these:
   - How did you get the two to look the same?
   - Do they stay looking the same?
   - How does their taste compare.

  - Do you think that the cream might be made of still other things? If so, what might they be?
  - Do you think that the skim milk might be made of still other things? If so, what might they be?

8. **If Activities 2.5.8 BUTTER and 2.5.9 CHEESE are to follow shortly, the cream and skim milk can be separated and refrigerated for the next activity. See Background.**

EXTENSIONS

- Have students report on the different kinds of milk and cream products found in a supermarket.
- Visit a dairy or creamery to observe the processing of milk.
- Have the students ask their grandparents how milk was delivered and processed when they were young.
- Have the students investigate *pasteurized, homogenized, skimmed* and other terms that are printed on milk containers.

2.5.8 BUTTER

The students
- Observe that cream separates out when unhomogenized whole milk stands.
- Separate whole milk into cream and skim milk.
- Make butter from cream.
- Observe that buttermilk remains after most of the butter is removed.
- Observe that foods are made up of different components.

BACKGROUND

This activity is the second in the sequence about milk and foods produced from milk. It should come after 2.5.7 MILK and should be followed within a day by Activity 2.5.9 CHEESE.

Nutrients

This activity builds the concept that foods such as milk are composed of many different components. Here the students recover butter which is part of the *activation* group. Milk itself is part of the *fabrication* group. Milk contains different things or nutrients that our bodies need for activation and fabrication. BUTTER continues to develop a model for the abstract idea of *nutrient* which is introduced in Activity 2.5.3. BASIC-THREE FOODS.

Organization

The suggested procedures are for students working in groups of 3-4, though this activity can be done as a whole class project.

STUDENT ROLE

Creamery technician

MATERIALS

unhomogenized whole milk or whipping cream
clean gallon jar to separate cream and skim milk if whole milk is used
ladle
clean glass baby food jars with lids

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cheesecloth squares 10–12 inches (25–30 cm) on a side
plastic spoons
salt
crackers
paper towels
Student Page 2.5.8 BUTTER

PRODUCTS

Butter
Buttermilk
Completed Student Pages

PROCEDURES

1. **Help the students discuss what they know about cream.**

   Ask such questions as these:
   - Has anyone ever whipped cream?
   - What happened to the cream when you whipped it?
   - Has anyone done anything else with cream?
   - When you shook whole milk what happened?
     ✔ Work to the idea that it homogenizes.
   - What do you think will happen when you shake cream?

2. **Have the students wash their hands and cover work surfaces.**

3. **If unhomogenized whole milk is used, separate the cream and skimmed milk.**

   Ask such questions as these:
   - What happened when the whole milk stood overnight?
     ✔ Observe that whole milk separates into layers.
   - How can you separate the skim milk from the cream?
     ✔ Get at separation by pouring or ladling very carefully.

4. **Have students recover the cream and skimmed milk and shake the cream.**

Have them

- Recover the cream into a clean, glass jar.
  ✔ Save the skimmed milk for Activity 2.5.9 CHEESE.

- Pour the cream into small baby food jars and secure the lids tightly.
  ✔ Check lids for tightness.

- Shake the jars and observe the changes that take place in the cream.
  ✔ Record observations on Student Page 2.5.8 BUTTER.

5. **When the students have produced butter, have them share their observations.**

   Ask such questions as these:

   - What happened when you first started to shake the cream?

   - When did the yellow globs begin to form?

   - Was the cream yellow?

   - Where do you think the yellow globs came from?

6. **Have the students recover and sample the products.**

   Have them

   - Separate the yellow globs from the liquid by pouring the liquid contents through cheesecloth into a clean container. Mold the remaining solid contents into a ball.

   - Taste the solid component.

   - Taste the liquid component.

7. **Have the students add a small amount of salt to the butter and taste again. Have them spread the butter on crackers for a snack.**

   Ask students such questions as

   - What do you think the yellow material is?
     ✔ Work to the idea of *butter*.

   - What do you think the liquid is?
     ✔ Work to the idea of *buttermilk*. Many students will never have had buttermilk and the name may have to be supplied.

- What does buttermilk taste like? Does it have a different taste from cream? From milk? From butter?

- What things have you found that are in milk so far?

- What group of the Basic–Three group is milk in?
  ✔ Work to the idea of the *fabrication* group.

- What group of the Basic–Three group is butter in?
  ✔ Work to the idea of the *activation* group.

- Why might one say that foods contain different nutrients or different things our bodies need?
  ✔ Work to the idea that you have found very different things in milk that supply different things our bodies need.

EXTENSIONS

- Run a test for the presence of water in the buttermilk using cobalt chloride paper.
  ✔ A first or third grade DASH teacher will probably have some cobalt chloride paper.

- Boil away the water in the butter milk and look for solids.

2.5.9 CHEESE

OBJECTIVES

The students
- Observe that cream separates out when unhomogenized whole milk stands.
- Separate whole milk into cream and skim milk.
- Make cheese from skim milk.
- Observe that whey remains after cheese curds are removed.
- Generalize that food is made up of different components.

BACKGROUND

This activity is the third in a series about milk and foods produced from milk. It should follow Activity 2.5.7 MILK and can be done along with Activity 2.5.8 BUTTER.

Once again there is reinforcement for the concept that foods such as milk are composed of many different components. This helps to develop the abstract idea of *nutrient* as a component of food. This idea is introduced in Activity 2.5.3 BASIC-THREE FOOD GROUPS.

Souring Milk

Skim milk will sour if left out of the refrigerator for several days. The curds can then be separated and turned into cheese. Skim milk can also be artificially soured by adding the enzyme *rennin*, often sold under the names Rennet or Junket. Another technique is to add a tablespoon of vinegar or lemon juice to a liter or quart of skim milk.

Organization

The suggested instructions are for students working in groups of 3–4, though the activity can be done as a class project. The first grade DASH teacher may have some cobalt chloride paper.

STUDENT ROLE

Creamery technician

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MATERIALS

unhomogenized or raw whole milk or skim milk
clean gallon jar to separate milk if unhomogenized milk is used
clean half-pint glass jars
muslin or cheesecloth squares 10–12 inches (25–30 cm) on a side
Rennet, Junket, vinegar, or lemon juice
plastic spoons
salt
paper towels
cobalt chloride paper
Student Page 2.5.9 CHEESE

PRODUCTS

Cottage cheese
Completed Student Pages

PROCEDURES

1. **Introduce the activity with a discussion about milk.**

   Ask such questions as these:
   - Does anyone drink skim milk at home?
   - Has anyone ever observed what happens when milk sits out of the refrigerator for some time?
     ✔ Get at the observation that a curd forms.
   - What do you think is happening?

2. **Have the students wash their hands and clean and cover their work surfaces.**

3. **If whole milk is used, discuss the separation. Observe whole milk separate into layers and recover the skim milk in a clean glass jar.**

4. **Explain that to speed up the souring of the skim milk an enzyme that is found in the stomach called *rennin* will be added. It's the enzyme that is used in the digestion of milk in the stomach. Add the commercial coagulant Rennet or Junket according to instructions on the package. See Background for alternative use of vinegar or lemon juice.**

Have the students
- Cover the milk container with cloth and place it in a cool corner of the room until it forms curds.
  ✔ This will take one to three days, at least over night.

- Observe the souring and the separation of the curds from the liquid whey.

- Separate the curds from the whey by pouring the contents through a cheesecloth or muslin filter.
  ✔ Discuss where the term *cheesecloth* came from.

- Squeeze out the remaining whey by making a bag of the cheesecloth or muslin and allowing it to drip dry.

5. **Have the students observe the curds and whey**.

Ask such questions as these:
- What does the curd look like?
- What does the curd smell like?
- What does the curd taste like?
- What does the whey look like?
- What does the whey smell like?
- What does the whey taste like?
- What was *Little Miss Muffet* eating in the nursery rhyme?

6. **Have the students add a small amount of salt to a sample of curds, and stir to produce cottage cheese. Have them taste the cheese.**

Ask such questions as these:
- How does a little salt change the taste of the curds?
- What have you found so far that is in milk?
- What do you think whey is?
- How could you test to find out?
  ✔ Get at using cobalt chloride paper to test for water.
- Do you think there is anything besides water?

- How could you find out?
  ✔ Work for boiling away the liquid.
  ✔ The liquid can also be evaporated by sunlight.

EXTENSION

- Have the students try making a sample of cheese using a different souring agent. Let the milk stand under cheesecloth until curds form. Compare cheeses made with different souring agents.

2.5.10 ENERGY FROM FOOD

OBJECTIVES

The students
- Review their working definition of energy.
- Test foods for energy content.

BACKGROUND

This activity is related to both the nutrition activity sequence and the energy activity sequence. It should follow Activity 2.5.3 BASIC-THREE FOOD GROUPS. ENERGY FROM FOOD demonstrates that foods in addition to having nutrient components also have an energy component.

Definition of Energy
The working definition of energy involves things that *go* or move, things that *glow* including heat and light, and things that *grow*.

Burning Food
In this activity food is burned. This should be done as a teacher-student demonstration where the teacher has control over the fire at all times. A candle should be used to light materials rather than matches. A tea light or votive candle set in an aluminum pie pan makes a safe setup. *Use hot mitts and tongs to hold foods.* All foods will burn because the major components are the nutrients, carbohydrates, fats, and proteins. All these nutrients will burn. Many regulation and fabrication foods, however, must be dried to burn in a flame. See the following table for expected results.

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Food Groups	***Nutrients of High Concentration***	***Nutrients Also Present****	***Flammability***
Activation (cereals, fats, sugar)	**carbohydrates, fats**	proteins, vitamins, minerals	**yes**
Regulation (fruits, vegetables)	**vitamins, minerals**	carbohydrates, proteins, fats	yes when dry
Fabrication (meats, milk products)	**protein**	vitamins, minerals fats carbohydrates	yes when dry

* Relative amounts of these nutrients are indicated by type size.

Foods that fit into the activation category have relatively large quantities of carbohydrates and fats and will normally burn readily. Examples are butter, bacon, crackers, and cereals.

Do not discourage the students from including wet foods such as lettuce, carrots, even milk. This will create anomalies and allow exploration of why they burn so poorly.

Safety
This activity presents an opportunity to discuss fire safety. Talk with the students about the need for adult supervision whenever fire is being used. They need to know where fire prevention equipment is located. See Burning Food above for some safety recommendations. Also see Activity 2.6.8 FIRE SAFETY.

STUDENT ROLE

Activity director

MATERIALS

Energy Rhyme
small fire extinguisher
matches
candles (votive or tea light variety)
metal pans to hold candles
tongs
hot mitts
fat (bacon)
toast

dry cereal
meat
wet and dried banana
other foods as desired
cobalt chloride paper
Working Dictionary
Connections Book
Student Page 2.5.10 ENERGY FROM FOODS

PRODUCTS

Completed Student Pages

PROCEDURES

1. **Introduce the Energy Rhyme.**

ENERGY RHYME

Energy is in everything that *goes*.
Energy is in everything that *glows*.
Energy is in everything that *grows*.

Energy we find in things that burn.
Energy we find in waters that churn.

Energy it takes to move a car.
Energy it takes to heat a star.

Energy we find in oil from the ground.
Energy we find in a voice making sound.

Energy comes from light of our sun.
Energy comes from a hot-cross bun.

Energy is in everything we eat.
Energy is in food making body heat.

Energy is in everything that *goes*.
Energy is in everything that *glows*.
Energy is in everything that *grows*.

2. Discuss energy and food groups with the class.

Ask such questions as these:

- What are some activation foods?
- Why must you eat activation foods?
  ✔ Get at making you move.
- How do activation foods relate to energy?
  ✔ Get at moving is going.
- What are some fabrication foods?
- Why must you eat fabrication foods?
  ✔ Get at making you grow.
- How do fabrication foods relate to energy?
  ✔ Get at growing.
- What are some regulation foods?
- Why must you eat regulation foods?
  ✔ Get at controlling what happens in our bodies.
- How do regulation foods relate to energy? Fabrication foods?
  ✔ This relates to the stanza energy is in everything you eat.
- What does the rhyme say that all foods produce?
  ✔ Get at making body heat.

3. Review the rhyme.

Ask such questions as these:

- How can you tell when something has energy?
  ✔ Repeat the first stanza of the rhyme—anything that *grows*, *glows*, or *goes*.
- How might you tell whether food contains or stores energy?
  ✔ Work to the idea that it might burn.
- What foods would you expect to burn?
  ✔ List the students' ideas and ask if they have ever seen their example burn—fat in the fire, toast, marshmallows, meat, other burned foods. and so forth.

4. **With the students design an experiment to test if foods burn or produce heat energy. Point out safety precautions. Work to the idea of holding things in a flame such as a candle and putting the candle in a non-flammable container.**

5. **Demonstrate with students the burning of foods. Use hot mitts and tongs to hold various foods in a candle flame. Have the students record their observations.**

6. **Summarize the activity.**

   Ask such questions as these:

   - What foods burned?
     ✓ List the foods.
     ✓ Get at the observation that all dry foods seemed to burn at least a little.
     ✓ Compare to their predictions from Procedure 3.
   - What foods did not burn well? Why might this be so?
     ✓ Get at the presence of water.
     ✓ Test for water. Squeeze or mash the foods.
   - What advantage might there be in cooking foods in water?
     ✓ Get at the idea of keeping them from drying out and burning.
   - How did your observations correspond to the rhyme.
     ✓ Repeat the rhyme.
   - Can you think of other living things that burn?
     ✓ Get at such things as grass, trees, hair, skin, and so forth.
   - What does your body use heat for?
     ✓ Get at keeping you warm.
   - Why must you be careful of fire?
     ✓ Get at the idea that we are made of things that burn.
   - What can fire do to you?
   - Do you need to change your working definition of energy?

7. **Discuss the reasons for learning about food. Record the students' ideas in the Connections Book.**

EXTENSION

- Have the students make fire safety aphorisms.

SP 2.5.1A

DASH

SUPERMARKET SURVEY
SP 2.5.1A

Name: ____________________

Date: ____________________

PREDICTIONS	OBSERVATIONS		MORE OBSERVATIONS
List the fruits and vegetables you think will be in the store.	YES	NO	List the fruits and vegetables the store had that were not on your list.

DASH

WHERE FOODS ARE GROWN
SP 2.5.1B

Name: ____________________

Date: ____________________

FOOD	GROWN HERE?		IF NO, WHERE CAN THE FOOD BE GROWN?
	YES	NO	

DASH

FOOD PREFERENCES
SP 2.5.2

Name: ______________________

Date: ______________________

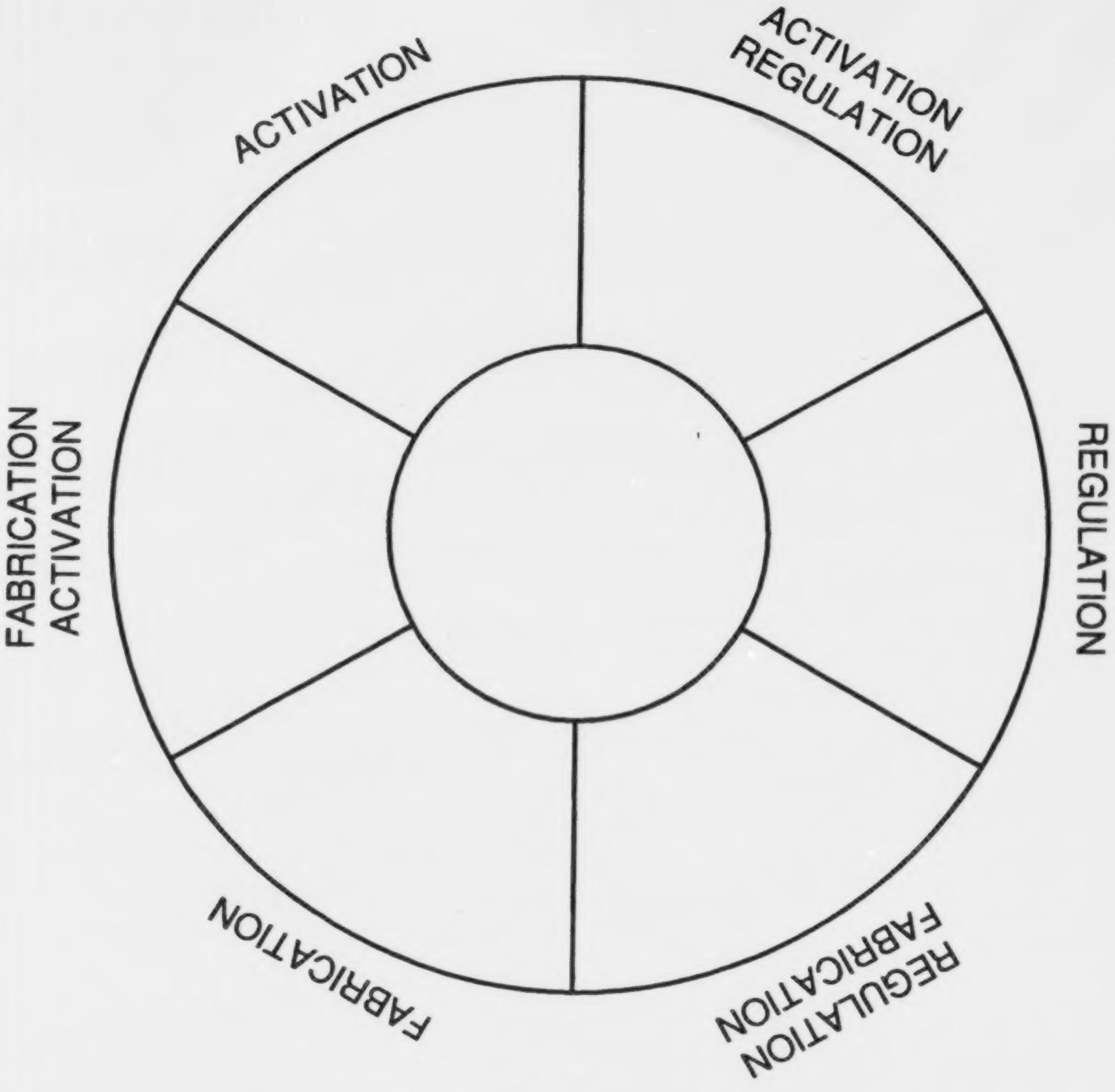
FOODS I LIKE	FOODS I DISLIKE

DASH

ARF FOOD-FUNCTION WHEEL
SP 2.5.3

Name: ______________________________

Date: ______________________________


ACTIVATION
ACTIVATION REGULATION
REGULATION
REGULATION FABRICATION
FABRICATION
FABRICATION ACTIVATION

DASH

NEW FOODS
SP 2.5.4

Name: ______________________

Date: ______________________

FOODS TO TRY	DATE TRIED	HOW MUCH EATEN?	HOW DO YOU FEEL ABOUT THE FOOD NOW?

DASH

IDENTIFYING FOODS
SP 2.5.5

Name: ______________________

Date: ______________________

Partner:

DATE	WHAT I THINK THE FOOD IS	WHAT THE FOOD REALLY WAS
1		
2		
3		

How many right?

How many wrong?

DASH

CHANGING FLAVOR
SP 2.5.6

Name: ______________________

Date: ______________________

FOOD	PLAIN		GARNISH 1		GARNISH 2		GARNISH 3	
	YES	NO	YES	NO	YES	NO	YES	NO

DASH

MILK
SP 2.5.7

Name: ____________________

Date: ____________________

List things that are the same.

HOMOGENIZED MILK	UNHOMOGENIZED MILK

List things that are different.

HOMOGENIZED MILK	UNHOMOGENIZED MILK

BUTTER
SP 2.5.8

Name: ____________________

Date: ____________________

Describe the cream before you shook it.

Describe the cream after you shook it.

DASH

CHEESE
SP 2.5.9

Name: ______________________

Date: ______________________

What did you use to make cheese?	
How did you make the cheese?	
Describe what happened to the milk.	
Describe the curds.	Describe the whey.

DASH

ENERGY FROM FOODS
SP 2.5.10

Name: ______________________

Date: ______________________

FOOD	OBSERVATIONS

DASH

GRADE 2
CLUSTER 6

Health and Safety

2.6.1 Growth Chart

2.6.2 Tooth Chart

2.6.3 Tooth Care

2.6.4 Getting Hurt

2.6.5 Getting Sick

2.6.6 Staying Well

2.6.7 Classroom and Playground Safety

2.6.8 Fire Safety

2.6.9 Using 911

GRADE 2
ACTIVITY GOALS

CLUSTER 6
Health and Safety

2.6.1 Growth Chart

To continue collecting personal growth data; to compare growth changes since DASH 1; to make predictions about growth; and to develop observation, graphing, reasoning, and recording skills.

2.6.2 Tooth Chart

To continue collecting personal tooth data; to compare tooth count with DASH 1 count; to make a graph of class changes; and to develop observation, mathematical, and recording skills.

2.6.3 Tooth Care

To review desirable tooth care practices; to relate number of cavities and tooth care; and to develop observation and recording skills.

2.6.4 Getting Hurt

To identify common injuries; to identify kinds of injuries adults should be told about; to develop a working definition of injury; and to develop observation, discussion, and reasoning skills.

2.6.5 Getting Sick

To identify common illnesses; to report person experience in recovery from illness; and to develop observation and discussion skills.

2.6.6 Staying Well

To identify cause of illness; to identify ways to avoid getting ill; and to develop discussion and reasoning skills.

2.6.7 Classroom and Playground Safety

To identify safety hazards in the school environment; communicate to authorities about hazards; to develop safety aphorisms; to develop a sense of advocacy; and to develop observation, reasoning, and recording skills.

2.6.8 Fire Safety

To identify the *do's* and *do not's* of fire safety; to make a fire escape map; to review use of 911; and to develop organizational, mapping, and reasoning skills.

2.6.9 Using 911

To identify situations where 911 calls are appropriate and inappropriate; to practice to be prepared to make 911 calls; and to develop reasoning skills.

2.6.1 GROWTH CHART

OBJECTIVES

The students
- Measure their height, weight, and area of their hands and feet.
- Compare class measurements.

BACKGROUND

GROWTH CHART is a continuation of a study begun in DASH K that will continue through DASH 6. In it the students measure their height, weight, and area of their hand and foot. Measurements are compared to give the students a sense of their own growth and a sense of the variability of growth among classmates. Care needs to be exercised here for some students may have developed a sensitivity particularly about their weight. This data may be kept as personal.

Counting Squares

To aid in measuring surface area, grid paper is used. To assure that the count is reasonably accurate have the students
- Number each full square as they count it.
- Count each partial square as half a square. Squares with less than half coverage will tend to equal squares with more than half coverage.

STUDENT ROLE

Physician

MATERIALS

scales
meter stick
grid paper for graphs
markers
Science Record Books
Student Page 2.6.1A GROWTH CHART
2.6.1B HAND SIZE
2.6.1C FOOT SIZE

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PRODUCTS

Graphs of changes in body measurements
Completed Student Pages

PROCEDURES

1. **Have the students measure their height, weight, and area of their hand and foot. Use Student Page 2.6.1A GROWTH CHART, 2.6.1B HAND SIZE, and 2.6.1C FOOT SIZE.**

   Have them record
   - Height in centimeters and inches.
   - Weight in kilograms and pounds.
   - Foot and hand size in number of square centimeters.

2. **Have the students compare their latest measurements with those taken in first grade. Record on Student Page 2.6.1A GROWTH CHART.**

   Have them calculate
   - Any height change.
   - Any weight change.
   - Any change in their hand or foot size.

3. **Help the students graph the class changes in each of the four dimensions. Make bar graphs. List the students across the bottom and the changes vertically. Students can be given a number or letter designation to keep identity confidential.**

4. **Discuss how the students are growing.**

   Ask such questions as these:
   - Are there any examples of decreases in height or weight?
     ✔ There may be decreases in weight.
   - Has everyone grown the same amount as everyone else? Why might this be so?
     ✔ Get at the idea that we are all different in the way we grow.

- Which of the measurements show the greatest overall increase?
- What do you think your dimensions will be the next time you measure them?

5. **Have the students store all records and predictions in their Science Record Books. Growth records are passed on for use in grade three.**

EXTENSION

- Have the students compare their growth between kindergarten and first grade with their growth between grade one and grade two.

2.6.2 TOOTH CHART

OBJECTIVES

The students
- Record the number of new and baby teeth, cavities, and missing teeth since first grade.
- Summarize the class data in graphs.

BACKGROUND

This activity continues a K–6 study that gives an ongoing log of tooth loss, new growth, and appearance of cavities and fillings. TOOTH CHART is a companion to Activity 2.6.1 GROWTH CHART. By keeping longitudinal records the students get a sense of natural human growth and change.

Home Activity

This can be treated as a home activity. Parents or caretakers can help students make the tooth count.

STUDENT ROLE

Dentist

MATERIALS

mirrors
Student Page 2.6.2 TOOTH CHART

PRODUCTS

Tooth graphs
Completed Student Pages

BEST COPY AVAILABLE

PROCEDURES

1. **Introduce the annual tooth inventory to the class.**

   Ask such questions as these:
   - How many teeth do you think you have now?
   - Has anybody lost a tooth?
   - Which tooth/teeth did you lose?

2. **Go over tooth inventory techniques with the students. Have them use mirrors to observe their own teeth. Use Student Page 2.6.2 TOOTH CHART.**

   Have them
   - Circle each tooth that is new since their last inventory.
   - Blacken in any gaps.
   - Put an (X) on all teeth that have cavities, fillings, or caps.

3. **Have the students verify each other's observations.**

4. **Review the class data.**

   Ask such questions as these:
   - How many teeth do you now have?
     ✔ Record these numbers for graphing.
   - How many teeth have you lost?
     ✔ Record these numbers for graphing.
   - How many teeth have you gained since your last inventory?
     ✔ Record these numbers for graphing.
   - What is the size of the new teeth compared to the old teeth?
   - How many cavities do you have now?
     ✔ Record these numbers for graphing.
   - How many cavities did you have last year?
     ✔ Record these numbers for graphing.
   - How many have fewer now than last year? How can this be?

- How many cavities do you have in new teeth?
  ✔ Record these numbers for graphing.

5. **Summarize the activity and help the students make bar graphs of the class data similar to the graphs they made in Activity 2.6.1 GROWTH CHART.**

EXTENSION

- Have the students look for labeled diagrams of teeth. Have them copy, label, and share their findings.

2.6.3 TOOTH CARE

OBJECTIVES

The students
- Review the steps of proper tooth care.
- Graph data on the number of cavities and the number of times people brush.
- Demonstrate understanding of proper tooth care.

BACKGROUND

This activity goes along with Activity 2.6.2 TOOTH CHART. Having surveyed the condition of their teeth, the students are asked to review their oral hygiene practices.

Approach

This activity is built around the students' tooth brushing for the past week. There may be some inaccuracies, but students will generally be able to estimate how often they have brushed their teeth. The assumption is made that what students have done over the past week is representative of what they do during the entire year. This may not be so if something unusual is occurring—holidays, outdoor camping, a presentation by a dentist, or other disruption of normal routines. Keep anonymity in reporting.

STUDENT ROLES

Practitioner of good dental health
Hygienist

MATERIALS

large tooth-jaw model
large tooth brush model
dental floss
Student Page 2.6.3 TOOTH BRUSHING

BEST COPY AVAILABLE

PRODUCTS

Completed Student Pages

PROCEDURES

1. **After the students have completed the tooth inventory in Activity 2.6.2 TOOTH CHART, have them assess their tooth brushing over the past week by completing Student Page 2.6.3 TOOTH BRUSHING.**

2. **Help the students collect data on brushing and cavities.**

   Have them record
   - The number of students who usually brush their teeth 0–6 times a week.
     ✔ Less than once a day.
   - Of these how many had 0 cavities, 1-2 cavities, 3–4 cavities, 5 or more cavities.
   - The number of students who usually brush their teeth 7–13 times a week.
     ✔ A least once a day.
   - Of these how many had 0 cavities, 1-2 cavities, 3–4 cavities, 5 or more cavities.
   - The number of students who usually brush their teeth 14 or more times a week.
     ✔ Two or more times a day.
   - Of these how many had 0 cavities, 1-2 cavities, 3–4 cavities, 5 or more cavities.

3. **Have the students make a class bar graph of cavities and brushing. There will be four cavity bars (0, 1–2, 3–4, and 5 or more cavities) in each brushing category 0–6, 7–13, and 14 or more brushes per week. Have the students contribute information anonymously.**

4. **Have the students analyze the graph.**

   Ask such questions as these:
   - Does the number of times you brush your teeth seem to be connected to the number of cavities? How?
     ✔ Usually the answer will be yes. If the data do not come out this way, continue the following dialogue.

   - Would you think it better to brush your teeth in the morning or night if you brush once a day? Why?
     ✔ Brushing at night leaves your teeth clean for all the time you are asleep. If you brush them only in the morning, you get them dirty when you eat breakfast.

   - Would you think it better to brush your teeth in the morning before or after breakfast? Why?
     ✔ By brushing before breakfast you get them dirty when you eat.

4. **Have the students demonstrate proper tooth brushing and flossing using the model.**

5. **Review the tooth brushing aphorism for good dental hygiene with the class.**

TOOTH BRUSHING

Brush twenty times up and twenty times down,
Inside, outside, all around.
Floss in between
To complete the routine.

EXTENSION

- Invite a dental hygienist to talk to the class about tooth care.

2.6.4 GETTING HURT

OBJECTIVES

The students
- List injuries they have had.
- Identify the kinds of injuries that adults should be told about.
- Write questions about injuries for response from a school nurse or other health professional.
- Create a working definition of injury.

BACKGROUND

This activity is a continuation of the health and self-sufficiency theme. Self-sufficiency is here associated with knowing what to do when an injury occurs. The activity is designed to alert students to the need to seek adult assistance whenever they or others have injuries that are potentially serious. Potentially serious injuries include any that break the skin, produce blood, continue to hurt, or those that students have doubts about.

Outside Resources

Because the students will have questions about different medical procedures that they have seen, it is suggested that a doctor or the school nurse be invited to answer questions. To increase the students' understanding, the groups submitting questions are asked to write up their interpretation of the professional's response. These interpretations should then be reviewed and corrected by the professional. When a professional is contacted, this correction aspect of the activity should be discussed and agreed to where possible.

STUDENT ROLE

Informed receiver of health care

BEST COPY AVAILABLE

MATERIALS

Working Dictionary
video camera (*optional*)
Student Page 2.6.4 INJURIES

PRODUCTS

Working definitions of injury and infection
Class book of injuries
Completed Student Pages

PROCEDURES

1. **Help the students distinguish between getting hurt and getting sick.**

   Help them
   - List ways they can get hurt.
   - List ways that getting sick is different from getting hurt.
   - Create a working definition of *injury* and record it in the Working Dictionary.

2. **Analyze the students' experiences with injuries. Check those experiences in which students can care for themselves and those that need adult help.**

   Ask such questions as these:
   - Have you ever hit your kneecap or your elbow ?
   - What did it feel like?
   - What happened to the pain after a short time?
   - Were you able to walk and move your arm afterwards?
   - Did you need help? Why?
   - Have you ever had the *breath knocked out of you?*
   - What did it feel like?
   - What happened to the pain after a short time?

- Were you able to breathe afterwards?

- Did you need help? Why?

- What about cuts? What do they feel like?

- Does the pain go away as it does when you hit your knee?

- Has anyone ever gotten an infection in a cut?
  ✔ This may require the addition of the word *infection* to the Working Dictionary. Infection involves getting germs into the body so that they attack surrounding tissue. Students may recall pus, redness, swelling, etc.

- How long did your infection take to heal?

- What do you do for cuts to keep them from getting infected?

- How are cuts different from hitting your knee?
  ✔ Work toward the idea that cuts allow germs to get into our body and infect it while just hitting the knee does not allow germs to enter the body.

- Have you ever broken a bone? Sprained an ankle?
  ✔ Use the same logic as with cuts, pointing out that they could not use the broken or sprained part of their body until it mended.

3. **Discuss with the students whom they should tell when they are injured.**

   Work to the conclusion that teachers or parents should be told about all injuries where
   - The skin is broken.
   - There is blood.
   - There is a burn.
   - There is continuing pain.
   - There is uncertainty about what has happened.

4. **Review the use of the 911 emergency number. See Activity 2.6.9 USING 911.**

5. **Have the students work in teams to create their own list of questions about how to take care of injuries. Work at getting questions that ask about certain procedures such as suturing, splinting, putting burns in water, washing wounds, and so forth.**

6. **Have the school nurse or a physician visit the class to discuss students' questions about injury. Tape or video the session if possible.**

   After the discussion
   - Have each team record their understanding of the answers to their questions.
     ✔ This recording is aided if there is a video or taped record of the discussion to review.

   - Have the visitor read over the statements of the students and make comments.

   - Review the comments with the students.

   - Have the students write thank you notes.

EXTENSIONS

- Use the Student Pages 2.6.4 INJURIES to make a class book of injuries.

- Have the students make up aphorisms about what to do when they get hurt.

2.6.5 GETTING SICK

OBJECTIVES

The students
- Describe different kinds of sickness.
- Relate what was done to help get well when they got sick.

BACKGROUND

This activity is designed to have the students share their experience with different kinds of sickness. Underlying this activity is the need for the students to begin to identify symptoms so they can share them with parents and doctors and get early treatment. Emphasize the fact that early treatment usually decreases the severity of a sickness.

STUDENT ROLES

Patient
Doctor

MATERIALS

chart paper
markers
Student Page 2.6.5 GETTING SICK

PRODUCTS

Concept map about getting sick
Class list about what doctors need to know
Class list about sickness
Completed Student Pages

BEST COPY AVAILABLE

PROCEDURES

1. **Have the students develop a concept map about the term *sick* and create a working definition of the term.**

   Bring out such ideas as
   - Not feeling well.
   - Running a temperature.
   - Feeling nauseous.
   - No appetite.
   - Taking medicines.

2. **Have the students name the kinds of sickness they have had and describe them. Use Student Page 2.6.5 GETTING SICK. Make a class list of sicknesses.**

   Ask such questions as these:
   - Can anyone name a sickness they have had?
     ✔ Get at specific examples such as colds, flu, pink eye, and so forth.
     ✔ Try to get several examples of the same sickness with descriptions.
   - What did it feel like to have this sickness?
   - What part of your body was involved?
   - What did you do to get better?
     ✔ Work for answers such as stayed in bed, drank lots of water, slept, took medicines, and so forth.
   - What did other people do for you?
     ✔ Get at the idea that other people might help a sick person by offering advice, calling a doctor, taking the person to a doctor, getting medicines, and so forth.

3. **Emphasize the importance of describing how one feels when one is sick. Discuss what doctors need to know to help us get well. Make a class list about what doctors need to know.**

Help students include such things as
- Where you feel pain. Why might the doctor need this information?
  ✔ Location of pain helps to tell where the sickness is located in the body.

- What kind of pain you are having. Why might the doctor need this information?
  ✔ The kind of pain helps tell what kind of sickness it is.

- How high your temperature is. Why might the doctor need this information?
  ✔ Temperature helps tell how sick you are.

- Whether you are having diarrhea or are vomiting. Why might the doctor need this information?
  ✔ These help tell what the disease might be.

- Whether you have a runny nose. Why might the doctor need this information?
  ✔ This is often an indication of a cold.

4. **Have the students review the sicknesses on the class list. Have them see whether they can form generalizations about the sicknesses.**

   Ask such questions as these:
   - What is a cold like? What do you do to get better?

   - What is flu like? What do you do to get better?

5. **Leave the students with the question, *Why do you want to find out what sickness you have as soon as possible?* Return to the question the next day for discussion.**

EXTENSIONS

- Have the students keep an ongoing record of sicknesses using SP 2.6.5 GETTING SICK.

- Have the students make up aphorisms about what to do when they get sick.

2.6.6 STAYING WELL

OBJECTIVES

The students
- Take a quiz on germs and microorganisms.
- Create working definitions for germ, microorganism, bacteria, and virus.
- Identify ways to prevent germs from entering their bodies.

BACKGROUND

In this activity the students are given information through a quiz. This kind of quiz will be new for many of them. It is not a test to be graded. It is a device to promote discussion and inquiry. In the discussion of the quiz the students arrive at definitions for germ, microorganism, bacteria, and virus. They then find ways of preventing germs from getting into their bodies.

A brief commentary is given along with the answers to the quiz. This activity can be enriched by presenting it with the help of the school nurse.

STUDENT ROLES

Sanitation
Health-conscious citizen

MATERIALS

Working Dictionary
Student Page 2.6.6 THE GERM QUIZ

PRODUCTS

Working definitions
Completed Student Pages

BEST COPY AVAILABLE

PROCEDURES

1. **Have the students take the Germ Quiz on Student Page 2.6.6. It will need to be read to them and interpreted. Go over the answers with them using the commentary on The GERM QUIZ ANSWERS pages.**

   Emphasize in the discussion
   - That most microorganisms are good and only a few, commonly called germs, make us sick.
   - How germs get into our bodies.
   - Where germs are found.

2. **Have the students develop working definitions for germ, microorganism, bacteria, and virus. Record them in the Working Dictionary.**

3. **Discuss the effects germs have on our bodies.**

   Include such ideas as
   - Our bodies have very good defenses against most germs.
   - Once germs start to grow in our bodies, we often get sick before our bodies can get rid of them.
   - Once they are in our bodies there are some germs our bodies cannot fight without medicines.
   - There are a few germs our bodies cannot get rid of even with medicines.
     ✔ One example is AIDS.

4. **Have the students work in groups to think of and list as many sources of germs as they can.**

   Help them include such sources as
   - Germs from used handkerchiefs.
   - Germs from coughing and sneezing.
   - Germs from using the toilet.

- Germs on food.
- Germs on eating utensils.
- Germs getting into a cut.
- Germs from working in the dirt.
- Germs from carrying out the garbage.
- Germs from contaminated drinking water or a dirty drinking fountain.
- Germs from food leftovers that have been stored improperly.

5. **Have the students list ways they can keep germs from getting into their bodies.**

Help them to include such ideas as
- Washing our hands.
- Using disposable tissues.
- Covering mouth and nose with a handkerchief or hand when sneezing or coughing.
- Turning their heads away from others when coughing or sneezing.
- Wiping thoroughly with toilet paper and flushing.
- Washing fruits and vegetables.
- Using sanitary cooking practices.
- Washing cuts.
- Using antiseptics.
- Boiling water.
  ✔ Chlorinating public drinking water.
- Recooking food left over from a previous meal.
- Refrigerating leftovers.

6. Have the students invent scenarios and role-play germs trying to get into their body and how they would protect against them.

7. Have the students take THE GERM QUIZ again to see what they have learned.

EXTENSIONS

- Invite the school nurse or a physician in to answer students' questions about germs.
- Create aphorisms for ways to prevent germs from entering the body.

The GERM QUIZ
ANSWERS

Check all answers you think are correct.

1. What is a germ?

___ Something that is dead.
✔ Being a microorganism it is very much alive.

X Something that is alive.
✔ Germs reproduce in our bodies and are alive.

X A microorganism that can make you sick.
✔ This is the common definition of a germ.

X Tiny things you cannot see.
✔ Being a microorganism it is visible only under a microscope.

2. What are microorganisms?

X Tiny plants, animals, bacteria, and viruses.
✔ Microorganisms include animals and molds as well as bacteria and virus which can only be seen using a microscope.

___ Tiny pieces of dirt.
✔ Microorganisms can often hold onto tiny pieces of dirt but they are not the dirt itself. Microorganisms are living things. Dirt is not living though it may have living things in it.

X Living things.
✔ All microorganisms meet the requirements of being able to reproduce, and are alive in that sense.

___ Not-living things.
✔ All microorganisms are alive

3 Do all microorganisms make you sick?

X Most microorganisms don't make you sick.
✔ Only a few of the countless microorganisms that exist can get into our bodies, live there, and make us sick.

X Many microorganisms are very helpful to you.
✔ Most of the microorganism in the world are helpful to us. They are the food for other living things. They help decompose our waste. Some microorganisms in our bodies even help in the digestion of our food.

___ All microorganisms make you sick.
✔ Most of the microorganism in the world are helpful to us.

___ Only dead microorganisms make you sick.
✔ It is usually the live microorganisms that make us sick, though some dead ones can also make us sick.

4. How big is a germ?

___ Most germs are about the size of a grain of sand.

___ Most germs are about the size of pin point.

___ Most germs can be seen with a hand lens.

X Most germs can be seen only with a powerful microscope.

5. How do germs make you sick?

X They can make poisons.
✔ Many bacteria produce poisons or toxins that kill or make our body function or work poorly.

___ They can burn you.
✔ Though they cause our temperature to rise, they do not get us hot enough to burn our bodies.

X They can eat your body.
✔ Many bacteria actually eat parts of the body they infect.

X They can keep your body from working correctly.
✔ Virus are well known for this. They take over some of the body's operation and cause the body to make more virus.

6. How do germs get into you?

_X_ Through the mouth.

_X_ Through the nose.

_X_ Through cuts.

_X_ Through any opening in the body.
✔ Bacteria, animal parasites, molds, and virus can get into the body through any opening including the eyes, tear ducts, the urogenital and anal openings, and mechanically through hypodermic needles, splinters, puncture wounds, and so forth.

7. Where are germs found?

_X_ In the air.

_X_ In the ground.

_X_ In water.

_X_ In and on everyone's body.
✔ Germs are found almost everywhere that precautions have not been taken to get rid of them. We are constantly exposed to germs.

8. How can we kill germs?

_X_ By washing with soap.

_X_ By boiling water.

_X_ By cooking food.

_X_ By using special chemicals.
✔ All of these techniques are used to kill germs and there are many more. The body can almost always kill the germs that get in it, but sometimes we get sick before it gets rid of all of them. What we want to do is keep germs out of the body so that we don't get sick. Therefore we put chemicals into our drinking water to kill germs, wash and cook our food, cover our nose and mouth when we cough, use a handkerchief when we blow our nose, and so forth.

2.6.7 CLASSROOM AND PLAYGROUND SAFETY

OBJECTIVES

The students
- Identify safety hazards in the classroom and on the playground.
- Develop skits about safety hazards.
- Create aphorisms about safety.

BACKGROUND

This activity should come early in the year. It is part of the continuing safety theme begun in DASH K. Safety should be a constant concern of the administration, support staff, the teacher, and the students.

Assessing the work Environment
DASH students should be encouraged to constantly look for hazards in their environment. In this activity, to reinforce the potential of danger, they act out skits about what could happen and make aphorisms to remind themselves of how to prevent these hazards.

STUDENT ROLE

Safety Engineer

MATERIALS

Connections Book
Student Page 2.6.7A SAFETY PROBLEMS
2.6.7B SAFETY APHORISMS

PRODUCTS

Completed Student Pages

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PROCEDURES

1. **Have the class inspect the classroom and playground to list conditions and situations that pose potential hazards. Have them use Student Page 2.6.7A SAFETY PROBLEMS.**

   Include such things as
   - Broken equipment.
   - Highly polished floors.
   - Frayed electrical wiring.
   - Places where running would be dangerous.
   - Areas that need to be kept clutter-free.
   - Doors that must not be blocked.
   - Improper treatment of equipment.
   - Improper behavior toward each other.
   - Improper disposal of trash.

2. **Have the students write letters to the school administration about hazardous equipment and conditions that need to be corrected.**

3. **Have the students work in groups to create safety skits and aphorisms.**

   Have them
   - Make up skits about what could happen if any of the potential dangers resulted in an accident.
   - Make up slogans or aphorisms to remind people about what to do to prevent potential accidents and record them on Student Page 2.6.7B SAFETY APHORISMS.

4. **Discuss the importance of learning about health and safety with the students. Record their ideas in the Connections Book.**

EXTENSIONS

- Have the students present their skits to other classes or to a school assembly.
- Have the students make posters to go with their aphorisms and hang them near potential hazards.

DASH 2.6.8 FIRE SAFETY

OBJECTIVES

The students
- Interpret a story about a girl in a fire.
- Identify things that they should do and should not do if caught in a fire.
- Review the importance of the emergency number 911.
- Make an escape route map for their school fire drill.
- Review fire drill rules.

BACKGROUND

This activity is ideal for Fire Safety or Fire Prevention Month. It is part of the continuing safety theme begun in kindergarten.

FIRE SAFETY begins with a story about a fire. To be caught in a fire is a terrifying experience. If any students in the class have had an experience of being in a fire they may be reluctant to share that experience. Do not press them. The Focus Book, *Mary Ellen's Story*, is vivid enough to present the character of a fire without having to rely on a firsthand account.

Testing Surfaces for Heat

There are several methods of testing a surface for heat. One is to use the back of the hand. There are problems: the back of the hand is not as sensitive as the fingers and palms and the thinner skin can be more readily injured. If touched by the palm or fingers the hand and arm will spontaneously recoil possibly unbalancing a person. Neither method of detecting fire by touch is ideal. It is suggested that student approach any surface cautiously trying to feel for heat *without* touching it.

STUDENT ROLE

Prepared safety-conscious citizens

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MATERIALS

Focus Book, *Mary Ellen's Story*.
Student Page 2.6.8 FIRE SAFETY

PRODUCTS

Fire Safety Map
Completed Student Pages

PROCEDURES

1. **Read the Focus Book *Mary Ellen's Story* aloud. Have the students tell what they remember. Read the story again to validate and expand their remembering.**

   Ask such questions as these:
   - Was Mary Ellen prepared for the fire? How?
   - How did she know there was a fire?
   - What did she do?
   - Did she do the best thing possible?
   - What else could she have done if anything?
   - Why is smoke dangerous?
   - Why should one test doors for heat?
   - Why should one have a plan to get out of a house?
   - When might you need to use the telephone number 911?
     ✔ Emphasis getting out of the house before calling 911. Use a neighbor's phone.

2. **Go over with the students the fire safety plan for the classroom.**

   Have the students
   - Walk through the fire drill route.
   - Walk through at least one alternative route in case the standard route is blocked.

- Draw a map of the routes they would take to safety. Use Student Page 2.6.8 FIRE SAFETY.

3. **Go over school fire drill rules and practical procedures with the class.**

   Discuss reasons for rules and procedures.
   - Why students must walk not run out of the class.
   - Why students should not talk until after attendance is taken at the assembly area.
   - Why each person should have two buddies to check on them.
   - Why there should be an alternate route.
   - Why it is essential to get out of the building as soon as possible.
   - Why you leave your belongings behind.

4. **After a fire drill is held discuss what happened. Announce to the students how long it took them to get to their assembly point. Do this each time there is a fire drill.**

   Ask such questions as these:
   - What problems did you have?
   - How can you overcome those problems?
   - How can you do better next time?

EXTENSIONS

- During Fire Prevention Month, have the students take home a fire prevention letter with a blank grid to make a home escape route map.
- Discuss the importance of smoke detectors in the home and the replacement of batteries at least once a year.
- Have a representative of the fire department come in and talk about fire safety at home and at school.
- Take a class field trip to the fire station.

2.6.9 USING 911

OBJECTIVES

The students
- Listen to the Focus Book, *The Day Something Happened.*
- Analyze the events in the story.
- Distinguish between situations in which 911 calls are appropriate and those in which they are not.
- Develop a plan of things to do when faced with an emergency situation.
- Simulate making 911 calls.
- Identify other places and numbers to call for help.

BACKGROUND

This activity deals with the very real problem of when and how to make a 911 emergency call. The Focus Book, *The Day Something Happened*, is used to initiate the activity. Following the discussion of events in the story, students analyze a series of scenarios to determine whether it is appropriate to call 911 or to do something else. They develop a general plan of things to do in an potential emergency situation. First, they find out what has happened. Second, they decide whether help is needed. Third, they do what they can. And fourth, if other help is needed, get it as soon as possible including calling 911.

The proper procedure in using the phone when calling 911 is discussed and practiced. Remind the students that 911 is a free emergency number and does not require a coin in a pay phone in most communities.

STUDENT ROLES

Emergency call maker
Emergency responder

MATERIALS

Focus Book, *The Day Something Happened*
Student Pages 2.6.9 EMERGENCIES

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PRODUCTS

Completed Student Pages

PROCEDURES

1. **Read the Focus Book, *The Day Something Happened*, and analyze the story. Then read the story a second time to be sure the recalled facts are correct.**

   Ask such questions as these:
   - What happened that made using the emergency number 911 necessary?
   - What evidence was there that it was necessary to get help?
   - What do you think happened to the baby sitter?
   - What happened the first time an attempt was made to make a phone call?
   - Why do you think the call did not go through?
   - What happened the second time the phone call was made?
   - Why do you think the second phone call was successful?
   - What did the person who answered the phone say?
   - Why would the 911 operator want to keep in contact with the caller?
   - Why wasn't the door opened immediately when help arrived?
   - Who came to help?

2. **Have the students tell about emergency situations they know of where the police or other emergency personnel were called.**

   Ask such questions as these:
   - Why were emergency people called?

- What was done before the emergency people arrived?
  ✔ Share events where the 911 operator has given lifesaving instructions over the phone.

- How did people know what to do?

- Was it really necessary to call emergency personnel?

- What could have happened if emergency people had not been called?

3. **Have student groups analyze a series of scenarios for appropriate actions to be taken.**

Scenario 1.
You are walking on the playground at school after lunch. Suddenly you see a kindergartner fall out of a swing and start crying. What do you do?

Help the students work to the four-step action model.

- Find out what has happened.

- Decide whether help is needed.

- Do what you can to help.

- If other help is needed, get it as soon as possible. Discuss whom to get or call for help.

Scenario 2.
You see smoke coming out of the house next door. What do you do?

Help the students to get at the need to

- Find out whether it is a backyard barbecue or other intentional fire.

- Warn any people in the house before calling for help.

- Call for help and help as best you can.

Scenario 3.
You see a robbery in a parking lot of a supermarket. What do you do?

Help the students to get at the need to
- Stay out of the incident.
- Get an adult, preferably a policeman, guard, or market employee.
- Make an emergency call if needed.

Scenario 4.
You are at home alone with your younger sister who swallows the liquid in a bottle under the sink and starts to scream. What do you do?

Help the students to see the need to
- Go immediately to the last step in the model—get help, call 911.
- Stay on the phone to give whatever information the operator needs to help until emergency crews arrive.

4. **Have the students make a list of emergency services from the phone book on a card that they can keep in their pocket or backpack. Have them invent a covering so the card will not be destroyed.**

   Have them include
   - General emergency 911.
   - Police.
   - Fire.
   - Poison Control.

5. **Have the students go over the need to use 911 in emergencies only.**

6. **Simulate making 911 calls in the classroom with one group of students playing the role of the 911 operator and one group making the call. This role-playing can be done as an extension of the scenarios above.**

7. **Have the students practice making 911 calls using the classroom-office intercom if available.**

EXTENSIONS

- Invite a 911 operator or other emergency service personnel to speak to the class.
- Send a letter home to parents asking them to go over 911 procedures with their child.

SP 2.6.1A

DASH

GROWTH CHART
SP 2.6.1A

Name: ____________________

Date: ____________________

GRADE	DATE	HEIGHT		WEIGHT/MASS		HAND	FOOT	NOTES: Any changes in measurements?
	Month/Year	(Inches)	(Cm)	(Pounds)	(Kg)	(sq. Cm)	(sq. Cm)	
K								
1								
2								
3								
4								
5								
6								

HAND SIZE
SP 2.6.1B

Name: ________________________

Date: ________________________

FOOT SIZE
SP 2.6.1C

Name: ______________________

Date: ______________________

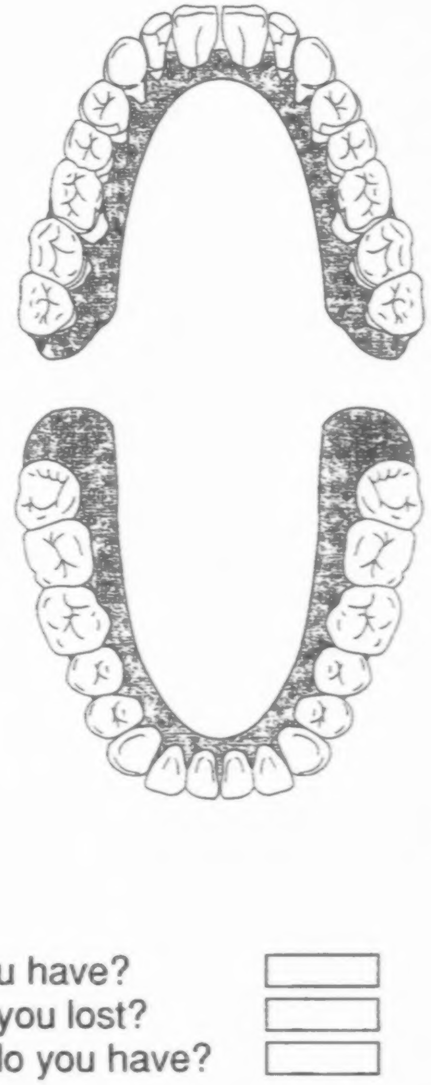
DASH

TOOTH CHART
SP 2.6.2

Name: ____________________

Date: ____________________

Blacken any missing teeth.
Circle any new teeth.
Put an "X" on any teeth with cavities, fillings, or caps.



How many teeth do you have? ☐
How many teeth have you lost? ☐
How many new teeth do you have? ☐

DASH

TOOTH BRUSHING
SP 2.6.3

Name: ______________________

Date: ______________________

DATE	DAY	BRUSHING RECORD		
		MORNING	NIGHT	OTHER

How many times did you brush your teeth? ☐

How many cavities do you have? ☐

DASH

INJURIES
SP 2.6.4

Name: ______________________

Date: ______________________

INJURY	HOW LONG TO HEAL?	OBSERVATIONS

DASH

GETTING SICK
SP 2.6.5

Name: ______________________

Date: ______________________

SICKNESS:
What part of your body had pain?
Did you have a temperature? How high?
What other symptoms did you have? (Vomiting, diarrhea, runny nose, etc.)
What did you do to get better?
What did other people do for you?

DASH

GERM QUIZ
SP 2.6.6
Page 1

Name: ____________________

Date: ____________________

Check all the answers you think are correct.

1. What is a germ?

__ Something that is dead.
__ A microorganism that can make you sick.
__ Something that is alive.
__ Tiny things you cannot see.

2. What are microorganisms?

__ Tiny plants, animals, and viruses.
__ Tiny pieces of dirt.
__ Living things.
__ Non-living things.

3. Do all microorganisms make you sick?

__ Most microorganisms don't make you sick.
__ Many microorganisms are very helpful to you.
__ All microorganisms make you sick.
__ Only dead microorganisms make you sick.

4. How big is a germ?

__ Most germs are about the size of a grain of sand.
__ Most germs are about the size of a pin point.
__ Most germs can be seen with a hand lens.
__ Most germs can be seen only with a powerful microscope.

DASH

GERM QUIZ
SP 2.6.6
Page 2

Name: ____________________

Date: ____________________

Check all the answers you think are correct.

5. How do germs make us sick?

__ They can make poisons.
__ They can burn us.
__ They can eat our body.
__ They can keep our body from working correctly.

6. How do germs get into us?

__ Through the mouth.
__ Through the nose.
__ Through cuts.
__ Through any opening in the body.

7. Where are germs found?

__ In the air.
__ In the ground.
__ In water.
__ In and on everyone's body.

8. How do we kill germs?

__ By washing with soap.
__ By boiling water.
__ By cooking food.
__ By using special chemicals.

SP 2.6.7A

DASH

SAFETY PROBLEMS
SP 2.6.7A

Name: ______________________

Date: ______________________

PROBLEM	LOCATION

DASH

SAFETY APHORISMS SP 2.6.7B

Name: ____________________

Date: ____________________

PROBLEM: ____________________

APHORISM: ____________________

PROBLEM: ____________________

APHORISM: ____________________

DASH

FIRE SAFETY SP 2.6.8

Name: ______________________

Date: ______________________

Draw a map showing the classroom and the place where the class goes in a fire drill. Draw "Standard Fire Drill Route" and "Alternate Fire Drill Route."

DASH

EMERGENCIES
SP 2.6.9

Name: ______________________

Date: ______________________

KIND OF EMERGENCY	PHONE NUMBER

DASH

GRADE 2
CLUSTER 7

Wayfinding and Transportation

2.7.1 Transportation Systems

2.7.2 Making Race Cars

2.7.3 Racing and Modifying Cars

2.7.4 Roads

2.7.5 Building a Village

2.7.6 Pedestrians in the Village

2.7.7 Bikes in the Village

2.7.8 Cars in the Village

2.7.9 Bikes and Trikes

2.7.10 Belts and Pulleys

2.7.11 Fast and Slow Pulleys

2.7.12 Gears and Wheels

GRADE 2
ACTIVITY GOALS

CLUSTER 7
Wayfinding and Transportation

2.7.1 Transportation Systems
To identify major components of transportation systems; to create working definitions of transportation system and system; and to develop recall, reasoning, and graphic art skills.

2.7.2 Making Race Cars
To invent, design, make and test a wooden race car; to invent a way to find the center of a circle; and to develop problem solving, drawing, planning, reasoning, and carpentry skills.

2.7.3 Racing and Modifying Cars
To race and modify a wooden race car; to design and make a hard surface race track; to develop rules to judge races; and to develop problem solving, planning, reasoning, and carpentry skills.

2.7.4 Roads
To design and construct a soft-surface race track; to race and modify a wooden race car; to correlate wheel width, speed, and softness of road surface; and to develop problem solving, planning, reasoning, and carpentry skills.

2.7.5 Building a Village
To design and make a village to practice rules of the road and to develop problem solving, planning, map making, scaling, measuring, reasoning, and construction skills.

2.7.6 Pedestrians in the Village
To practice using rules of the road as applied to pedestrians and to develop map making, map reading, direction finding, address finding, and reasoning skills.

2.7.7 Bikes in the Village
To make rules to govern bike safety in the village and to develop map reading, direction finding, address finding, and reasoning skills.

2.7.8 Cars in the Village

To make rules to govern automotive safety in the village; to develop the concept of speed as relating distance covered to time; and to develop map reading, direction finding, address finding, and reasoning skills.

2.7.9 Bikes and Trikes

To investigate how bikes and trikes work; to compare the ways they move wheels; to hypothesize as to why they move different distances for each turn of the pedal;and to develop carpentry, observation, measurement, and reasoning skills.

2.7.10 Belts and Pulleys

To construct belt and pulley systems; to predict and control the directions that the pulleys turn; and to develop observation, construction, reasoning, and recording skills.

2.7.11 Fast and Slow Pulleys

To assemble various belt and pulley systems; to predict the number of times one pulley causes rotation in another; to predict and control the directions that the pulleys turn; and to develop observation, construction, reasoning, and recording skills.

2.7.12 Gears and Wheels

To construct gear and wheel systems; to predict the number of times one gear causes rotation in another; to predict and control the directions that the gears and wheels turn; and to develop observation, construction, reasoning, and recording skills.

2.7.1 TRANSPORTATION SYSTEMS

OBJECTIVES

The students
- Identify a transportation system as a network of carriers, pathways, energy resources, maintenance and service resources, and so forth.
- Recognize the role, importance, and complexity of transportation systems in their daily lives.

BACKGROUND

This is the first of a series of activities on transportation. It should be followed by Activities 2.7.2 MAKING RACE CARS, 2.7.3 RACING AND MODIFYING CARS, and 2.7.4 ROADS. The students begin by making concept maps about transportation systems. This can evolve into development of a bulletin board display.

STUDENT ROLE

Graphic artist

MATERIALS

Working Dictionary
art materials
chart paper
markers
Student Page 2.7.1 TRANSPORTATION SYSTEMS

PRODUCTS

Working definitions
Bulletin board displays
Connected concept maps of transportation systems
Completed Student Pages

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PROCEDURES

1. **Help the students discuss the idea of a transportation system. Use the highway transportation system as an example. Make a concept map about transportation based on their responses.**

   Ask such questions as these:

   - What are used to carry things on highways—the carriers?
     ✔ Get at such things as cars, trucks, motorcycles, even bicycles.
   - What is carried or transported?
     ✔ Get at such things as people, food, furniture, gasoline, and so forth.
   - What do vehicles travel on?
     ✔ Get at such things roads, bridges, ferryboats, and so forth.
   - What else is needed to make a highway transportation system work?
     ✔ Work for such things as gas stations, motels, highway patrol cars, laws, and so forth.
   - What is a highway transportation system?
     ✔ Work for something like this: A highway transportation is all of the things that make up a highway system and all the things connected with using a highway system.
     ✔ Record their definition of a highway transportation system in the Working Dictionary.
   - Can you think of other kinds of transportation systems?
     ✔ Work for such systems for trains, boats, planes, and so forth?
   - What do we mean by *system*?
     ✔ Work for something like this: A system is something that has connected parts that work together. Examples of systems are transportation systems, schools, the mail system.

2. **Help the students make a list of other transportation systems. Help them include such systems as those built around trains, planes, bicycles, boats, people, the mail, and so forth. Record on Student Page 2.7.1 TRANSPORTATION SYSTEMS.**

Ask questions such as these:
- What systems operate in the air?

- What systems operate on the water?

- What other systems operate on the ground?

3. **Have student groups select a transportation system and make an illustrated concept map about it. Have the students make drawings of the parts on separate sheets of paper and attach them to their maps.**

   Help them
   - Include the categories from Procedure 1.
     ✓ Help them identify the kinds carriers, things transported, things traveled on, support services, and so forth,

   - Label their drawings.

4. **Help the class assemble their transportation systems on chart paper or on a bulletin board and show the connections between the parts of the systems.**

5. **Have the students explain their concept maps to the class.**

EXTENSIONS

- Have the students make a Transportation Systems Book for their concept maps and add to the maps as new things are found.

- Have the students make a bulletin board display about transportation systems with their concept maps.

2.7.2 MAKING RACE CARS

OBJECTIVES

The students
- Design and make race cars.
- Use carpentry tools.
- Invent a way to use jar lids for wheels.
- Invent a way to find the center of circular objects.

BACKGROUND

This is the second in the series of activities on transportation. Here the students make a car that they will race in Activity 2.7.3 RACING AND MODIFYING CARS. Skills are introduced that will be used in all later years of DASH. These include using a miter box in sawing, hammering nails, finding centers of circles, and working to design specifications.

This is a classical technology activity where the students invent, design, make, and test products. There are several component parts or products each demanding the same sequence of operations.

Materials

The Procedures outlined call for the use of wooden a car. Alternative materials can be used at the discretion of the teacher. Limit the size by specifying that the car should fit in a half gallon milk carton or similar sized *garage*. A piece of 2-inch x 2-inch soft pine block 4 inches long is a good size. This makes the total axle length about 3 inches including wheel attachment.

Car Design

Although the students sketch their designs on paper, the final products will likely be very different from their sketches. Experience is a constant modifier in technology and science.

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Wheel Problems
Three special problems will be confronted by the students. They will have to find the centers of their wheels, make axles, and make wheels that are stable—don't wobble. There should be as much exchange of design technique between the students as possible. When these practical problems arise act as a consultant and get at possible solutions through Socratic questioning.

Wheel Centers can be found by tracing the wheel on paper, cutting out the tracing, folding it in two, and then folding it in fourths. Placed back over the wheel the central tip of the folds will be the center of the wheel.

Axles can be nails, dowels, skewers, coat hanger pieces, or other inventions. For a smooth riding car, wheels pairs should be of the same size and usually directly opposite each other.

Non-wobbly wheels can be made by gluing two lids together, rim to rim. Provided the axle is at the center, this will hold the wheel up straight. Students may invent other workable solutions.

Work Surfaces
To prevent marring surfaces with saws fasten the miter box on a piece of heavy plywood or particle board that can be secured to a desk or other surface with clamps. To prevent marring floors with nails, have the students nail outdoors on heavy plywood, particle board, or a thick pad of newspaper.

Work Groups
It is best to have each student make their own car otherwise there should be no more than two persons in a group. Each student should have a chance to do some part of every task in the making and assembly of their car.

Sharing Tools
Different parts of the cars can be constructed at the same time, so that there need not be much waiting for particular tools. Wheels can be constructed while the car bodies are being sawed.

Tool Safety
Students need to be instructed in how to use all tools. A miter box is suggested to guide saw cuts. Sawing, drilling, and use of any hot glue gun will need to be supervised by an adult. This is an opportunity to involve parents. Goggles and face masks should be used to protect eyes from flying objects when hammering.

STUDENT ROLES

Automotive designer
Engineer
Carpenter
Inventor

MATERIALS

scrap pieces of heavy plywood or particle board to cover surfaces
    alternatively, use thick pads of newspaper
scrap 2-inch x 2-inch boards for car bodies (use soft woods)
jar and other lids
circular metal ends of frozen juice cardboard containers
hammers
saws
miter boxes
clamps
hand drill and bits
wire cutters
four penny and six penny box nails
four penny and six penny finish nails
long-shank upholstery nails with flat heads
wood dowels, small diameter
coat hanger wire
pliers
electrician's connection caps to secure wheels to axles
files or metal sandpaper to remove burs from wheels
wood sand paper
hot glue gun and glue sticks (*optional*)
wood glue
duct tape
miscellaneous alternative materials and tools as needed
Student Page 2.7.2 MAKING A RACE CAR

PRODUCTS

Race cars
Completed Student Pages

PROCEDURES

1. **Introduce the project to the class by announcing that they are going to make cars and race them.**

   To get started
   - Show the students the contents of the Inventor's Box.

   - Give the maximum dimensions for the cars: A 10-cm (4-inch) long block of wood for the body. Axle width maximum, 8-cm (3-inch) including wheels.
     ✔ Finished cars should fit in half-gallon milk-carton *garage*.

   - Have the students design their cars. Have them draw one or more side and top views using the grid on Student Page 2.7.2 MAKING A RACE CAR.

   - Have teams decide which design to use if they are not each making a car.

2. **Demonstrate use of tools while making prototype parts and instructing the students in how to proceed.**

   With the help of a student demonstrate
   - How to measure and saw a block of wood for the car body using a miter box.
     ✔ Have students jointly operate the miter box. Tell the students that they have the responsibility of sharing with others, ways they have found to make a task easier.

   - Finding the center of a lid by guessing.
     ✔ Show them how inexact this is and suggest they invent a method to better find wheel centers. This opens the door for later consultation.

   - How to punch or drill a center hole in a lid for an axle.
     ✔ Go over why a block should be placed under the lid before the hole is punched.

3. **Have the students make and test their cars.**

EXTENSION

- Have the students paint and otherwise decorate their cars.

401

2.7.3 RACING AND MODIFYING CARS

OBJECTIVES

The students
- Design and make a racetrack ramp.
- Develop race rules.
- Run their races.
- Modify their cars as needed.
- Observe that narrow wheels are generally faster on hard surfaces.

BACKGROUND

This is the third activity in the series of activities about transportation. Here the students race the cars made in Activity 2.7.2 MAKING RACE CARS. They design and make a racetrack ramp and create the rules to govern their races. Then they race their cars, modify them, and race again.

STUDENT ROLES

Engineer
Inventor

MATERIALS

boards, tables, cardboard for the racetrack ramp
duct tape
hammers
nails
protractor to measure angles
meter string cans from Activity 2.10.4 METER-STRING CAN
Inventor's Questionnaire from Activity 2.1.11 THINKING
Student Page 2.7.3A RAMP DESIGN
2.7.3B RACE RESULTS

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PRODUCTS

Race rules and awards
Racetrack ramp
Completed Student Pages

PROCEDURES

1. **Announce that the students need to make a racetrack ramp for their cars. Give the specifications.**

   It needs to
   - Be at least 1/2 meter (18 in) wide.
   - Be at least 2 meters (6 ft) long.
   - Have a smooth surface.
   - Have a hard surface.
   - Be tilted at an angle of 20° from the floor.
     ✔ This provides an opportunity to learn how a protractor is used to measure angles.

2. **Show the students the Inventor's Box and indicate other items in the room that can be used, such as table tops and removable book shelves. Have the students work in groups of three or four. NOTE: This is an ideal project for students who finish their cars early.**

   Have them
   - Hold a design contest for the best racetrack ramp. Use Student Page 2.7.3B RAMP DESIGN.
   - Vote on the best design or designs.
   - Have designers build the racetrack ramp or ramps.

3. **Hold preliminary match races between cars. Use the results of these races to help prepare for the *Big Race*.**

   Help the students
   - Modify their car designs.

- Come up with rules to run the races.

- Decide on a way to time races.

- Decide on what prizes are to be awarded.
  ✔ Have the students think of ways to give recognition to all participants.

- Racing pits can be set up to repair cars during the races.

4. **Help the students run the races and present awards. Record results on Student Page 2.7.3B RACE RESULTS.**

5. **Help the students make generalizations about the race cars.**

   Ask such questions as these:
   - What characteristics did the faster cars have that made them go faster?

   - How did narrow-wheeled tires perform compared to wide-wheeled tires?
     ✔ A seemingly wide-wheeled tire may really be narrow because of the bead on the rim of the lids used.

   - What characteristics did the slower cars have that made them slower?

6. **Have the student use Student Page 2.1.11 INVENTOR'S QUESTIONNAIRE from Activity 2.1.11 THINKING to reflect on their car construction.**

EXTENSIONS

- Have the students continue to redesign and race their cars.

- Set up a *pit stop* near the race track for emergency repairs during the races.

2.7.4 ROADS

OBJECTIVES

The Students
- Design and build a soft-surface racetrack ramp.
- Run their races.
- Observe that large, wide wheels compete best on soft surfaces.

BACKGROUND

This is the fourth activity in the series of activities on transportation. Here the students again race the cars made in Activity 2.7.2 MAKING RACE CARS but this time on soft-surfaces simulating mud, sand, or snow covered roads or grass covered slopes.

Soft-Surface Racetrack Ramps

Soft-surface ramps can be created several ways. Several wet layers of newspaper or lightly packed snow on a slide can be used. Even mud or sand can be used if the racing is done outdoors. A close-cut, steep, grassy hill can also be used. The track should have an angle of 30° to 40° and again be about 6 ft (2 meters) long.

STUDENT ROLES

Engineer
Inventor
Experimental car driver

MATERIALS

newspaper, sand, snow, or mud to resurface track
protractor
meterstring cans from Activity 2.10.4 METER-STRING CAN
Student Page 2.7.4A SOFT-SURFACE RAMP DESIGN
2.7.4B SOFT-SURFACE RACE

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PRODUCTS

Completed Student Pages

PROCEDURES

1. **Announce to the class that they are going to have another race and that this time they need to find or make a soft-surface, steep racetrack ramp. Tell them they are to simulate winter snow, a grassy slope, a sandy, or muddy road.**

   Have the students
   - Suggest soft-surfaces and test them out.
     ✔ If they suggest mud, you may wish to ask what could be used to simulate mud.
     ✔ Move in the direction of a thick pad of wet newspaper, unless the race is to be run outdoors.
   - Design a racetrack ramp 6 ft (2 meters) long with an angle of 30° to 40°. Use Student Page 2.7.4A SOFT–SURFACE RAMP DESIGN
     ✔ Again this is an opportunity to learn about protractors.
   - Decide on rules to run the race.
   - Decide on a way to time races.
   - Decide on what prizes are to be awarded.

2. **Have the students build their ramp and run the races. Record race results on Student Page 2.7.4B SOFT–SURFACE RACE.**

3. **Help the students make generalizations about their race cars.**

   Ask such questions as these:
   - What characteristics did the faster race cars have that made them go faster?
   - What characteristics did the slower cars have that made them go slower?
   - How did narrow wheels do compared to wide wheels?
   - What kinds of wheels are generally faster on hard surfaces? What kind on soft surfaces?

- What do you think makes this difference?
  ✔ Work to the idea that on soft surfaces narrow wheels sink down into the road slowing the car while broad wheels are supported. On hard surfaces less of the narrow wheels is on the road and there is less contact (friction) to slow the car.

- Can you think of other examples where large wheels have advantages over narrow wheels?
  ✔ Get at dirt bikes, dune buggies, and off-road vehicles.

- Can you think of other examples where narrow wheels have advantages over wide wheels?
  ✔ Get at street and hard track racing bikes.

EXTENSION

- Have the students race their cars on other kinds of surfaces such as bumpy or rocky.

2.7.5 BUILDING A VILLAGE

OBJECTIVES

The students
- Organize to build a village for practicing rules of the road.
- Plan the village.
- Give names to the village, streets, and parks.
- Orient the village using compass directions.
- Lay out and give numbers to lots.
- Construct a miniature village to fit the plan.

BACKGROUND

This activity is the first in a series dealing with rules of the road and extends the transportation system theme of Activity 5.7.1 TRANSPORTATION SYSTEMS. In BUILDING A VILLAGE the students design and build a village that will be used in Activities 2.7.6 PEDESTRIANS IN THE VILLAGE, 2.7.7 BIKES IN THE VILLAGE, and 2.7.8 CARS IN THE VILLAGE. The village is designed in sections according to an agreed-upon scale and is then built and assembled.

Rules of the Road

A major task of transportation engineers is to design highways to accommodate traffic needs of cities. A major part of that accommodation allows drivers and pedestrians to live by the *rules of the road* which are studied next. The students use the cars they made in Activity 2.7.2 MAKING CARS. Highways must be broad enough to allow passage of cars, one-way streets must be marked to prevent accidents, lights should be used to control the flow of traffic, and so forth. The students consider the importance of some of these things as they start to plan their village. Others will be recognized as the activity develops.

Organization

If the students are far enough advanced in their group organization skills, turn the organization of the village over to a Village Planning Commission. The design should be left to student inventiveness as much as possible.

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Streets

Since the students will be using their race cars, the Commission will need to decide on the width of streets. A two lane street about 20 cm or 8 inches wide will work if the cars were constructed to fit in a half gallon milk carton *garage*. Sidewalks can then be about 5 cm or 2 inches wide. The village should have the street features outlined in Student Page 2.7.5A VILLAGE PLAN IDEAS.

A full sized street plan can be laid out on 1 inch grid paper. A map drawn to scale can be laid out on cm grid paper. For example 1 inch can equal 1 or 2 cm.

Streets can be laid out with masking tape directly on tiled or rug-covered floors or on table tops. The activity can also be laid out on an asphalt surface using chalk. Streets should be named. A table top design allows participants to stand. A minimum area of 2 m X 5 m will be needed using the street dimensions suggested here.

A major consideration will be inventing a way to use space so that the students can reach all parts of the simulated village and manipulate their cars. A park in the middle gives a place for the students to stand or kneel to operate their cars. Have the students consider setting houses back from the highway so that they are not knocked over when cars are moved down a street. A outside circle road will keep cars within the village limits.

Blocks and Buildings

Several sections or village blocks will be needed. The size or length of a village block should be between 50 and 100 cm or between 1 and 1/2 and 3 ft. Blocks should be divided into lots and lots should be numbered.

Buildings can be constructed out of materials according to the inventiveness of the students. Village structures should include some of those listed on the Student Page 2.7.5A. Each car-building group needs their own house, condo or apartment, and garage or parking space.

STUDENT ROLES

City planner
Contractor/builder
Architect

MATERIALS

1-inch graph paper
1-cm graph paper
narrow masking tape
milk cartons
building materials as required by student designs
cardboard and small boxes
glue
duct and masking tape
stapler
tempera paint
brushes
markers
meter string cans from Activity 2.10.4 METER-STRING CAN
Student Page 2.7.5A VILLAGE PLAN IDEAS
2.7.5B VILLAGE PLAN SIZES
2.7.5B VILLAGE PLAN DESIGN

PRODUCTS

Rules for the village roads
Village map
Completed Student Pages

PROCEDURES

1. **Introduce the activity by explaining to the students that they are going to make a village big enough to use their cars and practice the rules of the road. Explain that they will have to reach all parts of the village as they move their cars through it.**

   Have the students
   - Read the specifications on Student Page 2.7.5A VILLAGE PLAN IDEAS.

   - Name their village.

   - Select a Village Planning Commission to organize the village planning.

2 **Sit down with the Commission to help them design the city. Alternatively, if there is plenty of time, this can be done as a whole class activity.**

- Help the Commission design the street plan.
  ✔ Have them keep in mind that the students will need access to all streets and sidewalks when they are moving their cars.

- Help them divide the village into blocks or sections to be designed by the village citizenry.
  ✔ Have enough sections for one per group of 3–4 students to design.

- Help them establish lot size and the maximum size of the buildings. Scale is not important except for the streets, parking spaces, and garages.
  ✔ It is suggested that milk cartons and other small boxes be used for buildings.

3. **Have the Village Planning Commission coordinate the design of the village.**

The Village Planning Commission should

- Assign contracts for various village construction projects—decide who takes on each task.
  ✔ The city hall, shopping center, fire department, police station, hospital, theater, school, churches, and so forth. These should be done by teams of two or more students.

- Solicit plans for the different blocks or sections of the village.

- Assemble the plans on a master map and resolve mismatches.

- Direct the naming of the streets and the assigning of street numbers.
  ✔ Be sure to use compass directions.

- Direct the laying out the village streets according to the plan.

4. **Have the Village Planning Commission supervise the building of the village.**

EXTENSIONS

- Have the students collect plans or blueprints for various buildings and make a bulletin board display.
- If construction is taking place in the school neighborhood, arrange a field trip to see the operation.

2.7.6 PEDESTRIANS IN THE VILLAGE

OBJECTIVES

The students
- Map the village.
- Use map-reading skills.
- Practice giving and interpreting directions.
- Make pedestrian rules.

BACKGROUND

This activity is a companion to Activities 2.7.7 BIKES IN THE VILLAGE and 2.7.8 CARS IN THE VILLAGE and can be done concurrently with them. In PEDESTRIANS IN THE VILLAGE the students use the village designed in Activity 2.7.5 BUILDING A VILLAGE to practice map making, map-reading, wayfinding, and finding locations.

The students first make small personal maps of the village. Then they make highway pedestrian rules and vote on a set of village ordinances to guide walking through the village. Finally they play the *Package Pickup and Delivery Game*. The pickups and deliveries are guided by delivery instructions using the students' maps.

STUDENT ROLES

Cartographer
Highway safety expert

MATERIALS

chart paper
drawing materials
Village from Activity 2.7.5 BUILDING A VILLAGE
Student Page 2.7.5A VILLAGE MAP
Student Page 2.7.5B PICKUP AND DELIVERY

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PRODUCTS

List of pedestrian rules
Individual village maps
Completed Student Pages

PROCEDURES

1. **Have the students make small personal maps of the village to use in finding their way around town. These can be sketched to scale on Student Page 2.7.6A VILLAGE MAP.**

   Ask such questions as these:
   - What does your map show?
     ✔ Get at such things as street names, buildings numbers, compass directions, and so forth.
   - Is your personal map drawn to scale?
   - How does your personal map differ from the one that the Village Planning Commission drew? How is it similar?

2. **Introduce the students to the need for having a set of rules or ordinances concerning pedestrians. Have the Planning Commission convene a review of safety ordinances for pedestrians. Have the students discuss and vote on ordinances governing pedestrians. Post all ordinances that are voted into law.**

   Help the students include such things as
   - Obeying lights.
   - Using crosswalks.
   - Facing traffic when walking where there is no sidewalk.
   - Not crossing in the middle of a block.
   - Wearing white at night.

3. **Introduce the students to the *Package Pickup and Delivery Game.* In Part 1 the students work in teams of 2 or 3 persons to develop instructions to pick up a package and deliver it to an address. Use Student Page 2.7.6B PICKUP AND DELIVERY.**

Have each group

- Decide where they want the package to be picked up and where the package is to be delivered.

- Decide where the person picking up the package is to start their walk.

- Write out instructions to get from the starting point to the package pickup location, and then to the place of package delivery.
  ✔ Initially limit the students to 6–8 instructions. Additional rounds can be played with a larger number of instructions.
  ✔ Use directional pickup instructions that may include compass directions, right-and-left directions, street names, descriptions such as "right at the light" or "enter the shopping center," and so forth.
  ✔ *No* address number may be used for the pickup point.
  ✔ Be sure the delivery instructions have the address number of the place where the package is to be delivered.

- Make a cut-out figure to represent a pedestrian.

4. **In Part 2 the students from another team must follow the instructions to pick up and deliver the package. The team members who wrote the pickup and delivery instructions act as police to be sure that ordinances for pedestrians are followed. They may give out tickets for violation of ordinances. All teams should have a chance to pick up and deliver a package and to act as police officers.**

Have the delivery team

- Use the cut-out figure to simulate walking to pickup and deliver the package.
  ✔ Several teams can be on the streets at one time.

- Move the pedestrian according to instructions. They must follow the path described and follow all laws and ordinances.

- When an ordinance is to be not followed, record what the ordinance is on the ticket.
  ✔ For example, stopping, looking left then right before crossing a street, no trespassing on private property, walking on the side of the road facing traffic when there is no sidewalk.

5. Summarize the activity with the class.

Ask such questions as these:

- Did anyone receive a ticket for violation of an ordinance?
- What was the violation?
- Are you satisfied that you were ticketed fairly?
- If you thought that you were unfairly ticketed what would you do?
  ✔ Get at the idea of going to court.
- Did anyone have difficulty in finding a package?
- Why was it difficult to find the package?
- Did anyone have to go back to the instruction writing team for further instructions?
- Are there some ways that give better instructions than other ways?
- How is using a numbered address different from giving other types of directions?
- What advantages are there in using different kinds of directions? What disadvantages?

EXTENSION

- Have the students play additional rounds of the game with a larger number of instructions.

DASH

2.7.7 BIKES IN THE VILLAGE

OBJECTIVE

The students
- Make bicycle safety rules.
- Practice giving and following directions.

BACKGROUND

This activity is the third in the series dealing with the rules of the road and is a companion to and can be done concurrently with Activities 2.7.6 PEDESTRIANS IN THE VILLAGE and 2.7.8 CARS IN THE VILLAGE.

In BIKES IN THE VILLAGE the students use the village constructed in Activity 2.7.5 BUILDING A VILLAGE to establish the special rules for bicycles and then play another round of the *Package Pickup and Delivery Game*.

STUDENT ROLE

Bicyclist
Police Officer
Highway safety expert

MATERIALS

chart paper
markers
cutout bicycle model
village from Activity 2.75 BUILDING A VILLAGE
Student Page 2.7.7 PICKUP AND DELIVERY

PRODUCTS

List of traffic rules for bikes
Completed Student Pages

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PROCEDURES

1. **Have the Planning Commission convene to review safety ordinances for bicycles. Have the students devise, discuss, vote on, and post all ordinances.**

   Help the students include such things as

   - Obeying traffic lights.
   - Using bike lanes.
   - Which side of the road to ride on.
   - Using hand signals.
   - Wearing helmets.
   - Parking and locking bikes.
   - Licensing bikes.
   - Wearing white at night.
   - Using lights at night.
   - Using bike flags.

2 **Have the students play additional rounds of the *Package Pickup and Delivery Game* found in Activity 2.7.6 PEDESTRIANS IN THE VILLAGE. Substitute cutout bicycles for their pedestrians. Have groups use Student Page 2.7.7 PICKUP AND DELIVERY to record their instructions.**

EXTENSION

- Write aphorisms for bicycle rules.

2.7.8 CARS IN THE VILLAGE

OBJECTIVES

The students
- Use their miniature village to practice rules of the road.
- Use map-reading skills.
- Practice giving and interpreting directions.
- Build some beginning insights into the concept of rate of speed.
- Make car safety rules.
- Reflect on the importance of organization in the world around them.

BACKGROUND

This activity follows Activities 2.7.6 PEDESTRIANS IN THE VILLAGE and 2.7.7 BICYCLES IN THE VILLAGE. In CARS IN THE VILLAGE the students test how well they have succeeded as traffic engineers, city planners, traffic police, and citizen users of the streets and byways of their village when they play the integrated traffic game.

Approach

Following the procedure they practiced in PEDESTRIANS IN THE VILLAGE and BICYCLES IN THE VILLAGE, the students first make rules for cars. and then they develop new travel plans for pedestrians, bicycles, and cars. This time they are held to speed limits, being able to move some set number of centimeters (or inches) in 5 seconds. Again, team members making the travel plan act as police officers.

Pace of Game

Start out with only a few vehicles on the streets in the beginning so that the students can see how the speed limits hold the game in check. Add vehicles as they become more familiar with the game. When a team finishes going through a travel plan they can reverse roles with the students who were the police officers.

Speed Limits

The game will require some adjustment according to the amount of space that the village takes up. By limiting the students to moving at a maximum 20–25 cm per 5 seconds the village can probably accommodate a class of 24–30 students.

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STUDENT ROLES

Police officer
Traffic engineer
City planner
Pedestrian
Bicyclist
Automobile drivers
Highway safety expert
Judges

MATERIALS

chart paper
cardboard
markers
meter-string cans
masking tape
serrated knives
scissors
watch or clock with second hand
Individual village maps
Connections Book
Student Page 2.7.8 TRAVEL PLAN

PRODUCTS

List of traffic rules for cars
Completed Student Pages

PROCEDURES

1. **Have the Planning Commission convene a review of safety ordinances for automobiles. Have the students devise, discuss, vote on, and post their ordinances for cars.**

   Help the students include such things as
   - Pedestrians have the right of way.
   - Obeying signs and traffic lights.
   - Stopping for school buses.

- Pulling off to the right and stopping for an emergency vehicle when its siren is sounding or lights are flashing.
- Traveling on the right side of the road.
- Signaling for turns.
- Using seat belts.
- At a stop sign the person on the right has the *right of way* or the right to move first.
- Following police instructions.

2. **Have a Highway Department groups mark the streets and highways in 5 cm *speed* segments. These can be marked on the tape outlining the streets and byways.**

3. **Have the Planning Commission establish speed limits and the time for lights to change. Have the Highway Department group post speed limit signs along the highway. Include signs announcing the approaches to speed zones, the starts of speed zones, and the ends of speed zones with speed limits on all signs.**

   Some suggested speed limits and times
   - Cars in School Zones, 10–15 cm/5 sec.
   - Cars in residential or business zones, 20–30 cm/5 sec.
   - Bikes, 10–15 cm/5 sec.
   - Pedestrians and joggers, 5–10 cm/5 sec.
   - Time for stoplights to stay red and green, 20 sec; yellow, 5 sec.

4. **Have the Planning Commission identify the village Professional Employees.**

   Have them include
   - A police force.
     ✔ Made up of members of the groups which wrote the travel plans being used in the village.
   - A timekeeper team.
     ✔ Responsible for calling out time during the running of the game by announcing each 5 second interval.

- A stoplight changer team.

- A judicial team.
  ✔ A team of judges, to resolve disputes and keep the game flowing.

5. **Part 1: Introduce the students to the Community Transportation Game. Have them work in teams of 2 to develop travel instructions for a car to travel through and about the village. Have them develop a second plan for a pedestrian or bicycle to travel the streets and sidewalks of the village. Use Student Page 2.7.8 TRAVEL PLAN. Have them test their travel plans.**

6. **Part 2: Have the students play of the Game using their own set of travel instructions.**

A suggested sequence of play

- Begin. It is early in the morning. One or two cars are on the streets with one or two pedestrians and bicycles.

- The timer calls time in 5-second intervals while cars, bicycles and pedestrians move within the speed limits along their planned route.
  ✔ Time can be stopped whenever needed to get the game on track or to make comments.

- The stoplight changer works the stop lights.

- Drivers, bicyclist, and pedestrians are paired. The back-seat driver, cyclist, or pedestrian companion reads the instructions. The driver moves the car and tells what is to be done, as does the bicyclist, and pedestrian.
  ✔ At each decision point the drivers, bicyclist, and pedestrian must state or say what they are doing. For example, when a driver gets into a car, the driver says I am fastening my seat belt; when a left turn is made the driver says I am turning on my left turn signal and turning left; and so forth. A pedestrian must wait for a light and say I am looking left then right when crossing a street, and so forth. A bicyclist must likewise follow the bike rules.

- Writers of the travel plan act as driving, cycling, and pedestrian testers. Tickets are given out on the basis of the operators incorrect description of actions to be taken, traveling within speed limits, stopping for lights, and so forth.

Police can drive their cars to a site of violation at any time and give tickets.
✔ Be sure police cars don't clog the streets.

- Add a few vehicles at a time as the students get used to going through their travel plans.

7. **Part 3: Have the students exchange instructions and continue the game.**

8. **Summarize the activity with the students.**

Ask such questions as these:

- Did anyone get a ticket?
- What was the violation?
- Are you satisfied that it was a fair ticket?
  ✔ If not activate the judiciary team to hear the case.
- How did putting a speed limit on different areas of the village affect the flow of people, bikes, and cars?
- What do you think would happen if there were no speed limits?
  ✔ Have a few students try the Game in a village without speed limits.
- What were the problems in traffic?
- What problems did pedestrians cause cars?
- What problems did cars cause pedestrians?
- How good were your rules and ordinances? What changes would make things flow better?
- How are problems of organizing traffic like organizing your desk?
  ✔ Get at the idea that in the village, if there was no organization through rules for traffic, people could get hurt, get delayed in going places, and very angry. If we don't have a plan for our desks, we can get hurt by sharp things that we don't see, get delayed in finding things, and get very frustrated.
- Why is organization so important to the way our world works?
  ✔ Record their ideas in the Connections Book.

EXTENSION

- Have the students develop citations for being *outstanding* drivers, pedestrians, and bicyclists.

2.7.9 BIKES AND TRIKES

OBJECTIVES

The students
- Investigate bikes and trikes to find out how they are moved.
- Investigate why there are two pedals.
- Hypothesize why one complete rotation of a bike pedal drives the bike further than one complete rotation of a trike pedal.

BACKGROUND

This activity looks at how trikes and bikes are moved. It is followed by Activity 2.7.10 BELTS AND PULLEYS, 2.7.11 FAST AND SLOW PULLEYS, and 2.7.12 GEARS AND WHEELS.

Approach

BIKES AND TRIKES starts with a comparison of walking with the pedaling of bikes and trikes. The distance that a trike will move with one rotation of the pedal is fairly easy to conceptualize and demonstrate. However, the movement of the bike in relation to the full rotation of the pedal is more difficult to conceptualize and becomes the anomaly to be explored in Activity 2.7.10 BELTS AND PULLEYS.

At least one bicycle and tricycle are needed for this activity.

STUDENT ROLES

Physicist
Cyclist
Engineer

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MATERIALS

bicycle
tricycle
masking tape
string
meter-string cans from Activity 2.10.4 METER-STRING CAN
Student Page 2.7.9 TRIKES AND BIKES

PRODUCTS

Completed Student Pages

PROCEDURES

1. **Introduce the activity by asking how riding a trike or bike is like walking.**

   Help the students get at such ideas as
   - In walking or bike or trike riding you move by using your legs and feet.
   - In walking or bike or trike riding you push with your legs and feet.
     ✔ When walking you push on the ground with your feet. When on a trike or bike you push on the pedals with your feet.
   - In walking or bike or trike riding you raise and lower one foot after the other.

2. **Have a student demonstrate riding a bike and another demonstrate riding a trike to verify the similarities.**

3. **Ask how riding a bike and a trike is different from walking.**

   Help the students get at such ideas as
   - To move in walking you push with your feet against the ground. In bike and trike riding you move by moving a wheel which pushes against the ground.
   - When a bike or trike is moving, its wheels are always in contact with the ground. When you walk, one foot touches the ground, a space is left, then the other foot touches the ground and this is repeated over and over.

4. **Ask how far the students can walk in two steps. Have them measure the distance they travel in two steps using their meter-string cans. Use Student Page 2.7.9 TRIKES AND BIKES to record measurements.**

5. **Ask how far a trike moves with every complete rotation of the pedal. A complete pedal rotation is from its starting position back to the starting position or 2 *steps*. Have the students invent a way to find out.**

   Help the students if needed by asking such questions as:
   - What is a complete *rotation* of the pedal?
     ✔ Help them to see that 2 steps on the pedals return the first pedal to its starting position.

   - What determines how far the trike will move?
     ✔ Work to the idea that the trike travels a distance equal to the distance around the wheel or one wheel rotation.

   - How could you measure the distance around or *circumference* the wheel?
     ✔ Work to the idea of wrapping the string of their meter-string can on the outside of the trike's tire. Wet string will stick to the wheel.

   - How can you check to see if this distance is the same as the distance that the trike moves in one turn of the wheel?
     ✔ Get the idea of laying out the string and seeing if the trike really travels that far in one complete rotation of the pedal. Use masking tape to a mark starting line.

6. **Ask how far will the bike will move for every complete rotation of its pedal. Have them predict and then invent a way to find out.**

   Help the students if needed by asking such questions as:
   - What is the distance around or circumference of the bike wheel?
     ✔ Help the students measure as before.

   - Is this the same as the distance the bike traveled in one complete rotation of the pedal?
     ✔ They should find that it is much less.

   - How can the distance the bike moved be more than the distance around or circumference the wheel?
     ✔ Have them turn the bike on its side and observe the turning of the wheel and the turning of the pedal.

- How many times did the wheel turn with one complete rotation of the pedal?
  ✔ Have them try to count the turns.

- How could this help us determine how far the bike will move with one complete turn of the pedal?
  ✔ Have them try their ideas.

- If the wheel turned twice how many times would you have to lay your circumference string out?
  ✔ Get at twice and have them apply the same idea to the distance the bike will travel.

7. **Summarize the activity.**

Ask such questions as

- Do you get more distance from 2 steps walking, 2 steps on the pedals of a trike, or 2 steps on the pedals of a bike?
  ✔ The answer will be variable depending on the size of the student and the sizes of the trike and bike wheels. However, the expected results would be walking least, trike next, and the bike the longest distance.

- Why do you travel farther with a complete rotation of the pedal on a bike than a complete rotation of the pedal on a trike?
  ✔ Get at the idea that the wheel goes around more times for one complete rotation of the pedal than does the wheel of the trike. The wheel of the bike may also be larger than the trike's.

EXTENSION

- If the bike has several speeds, have the students try to observe what will happen when the gears are changed.

2.7.10 BELTS AND PULLEYS

OBJECTIVES

The students
- Use carpentry skills.
- Make pulley boards.
- Assemble various pulley combinations.
- Make and test predictions about the direction one pulley will turn another.
- Make and test predictions about the number of times one pulley will turn another.
- Invent ways to connect pulleys to solve problems.

BACKGROUND

This activity should follow Activities 2.2.8 ANALOG TIME and 2.7.9 BIKES AND TRIKES and precede Activities 2.7.11 FAST AND SLOW PULLEYS and 2.7.12 GEARS AND WHEELS. BELTS AND PULLEYS looks at the directions wheels rotate and how that direction can be changed. The terms *clockwise* and *counterclockwise* reinforce use of analog clocks.

Sprockets

When a pulley has teeth to engage a chain, it is called a *sprocket*. Bicycles have one or more sprockets attached to the pedals and one or more attached to the rear wheel. These sprockets or special pulleys are connected by a special belt, the chain.

Approach

After reviewing their work with bikes and trikes, the students make a pulley board to hold their pulleys. Then they are given four investigations and a set of challenges to explore.

Making pulley boards

Pulley boards start with a board 1 or 2 in thick, 6 or more inches wide, and 10–12 in long.

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Pulleys can be metal or plastic lids with a hole in their center.

- Lid centers can be found by tracing the lid on paper, cutting out the tracing, and folding the paper in fourths. The center will be at the tip of the center fold.
- To prevent splitting, plastic lids will need to have a pre-drilled hole in their center.
- Holes can be made in metal lids with a hammer and a nail. Be sure the surface beneath the lid is protected.
- Remove the burs with a metal file or metal sandpaper.
- Lids can be placed either top down or up.
- Axles to secure the lids to the board can be made from flat-headed upholstery tacks or nails.
- Lids should turn freely on their axles.
- To prevent tacks and nails from going through the board use a 1/2–3/4-inch tacks and nails.
- Tacks need not be driven deeply into the board since they only hold the pulleys in place. The shallower tacks are driven, the easier it is to remove them and reposition the pulley.
- Belts can be rubber bands or string.

Tool Safety
Students need to be instructed in how to use all tools. A miter box is suggested to guide saw cuts. Sawing, drilling, and use of hot glue guns will need to be supervised by an adult. This is an opportunity to involve parents. Goggles and face masks should be used to protect eyes from flying objects when hammering.

STUDENT ROLES

Physicist
Inventor
Engineer

MATERIALS

bicycle
tricycle
scrap lumber to make pulley boards 1 in x 6 in x 12 in (or larger and/or thicker)
sixpenny nails to punch axles
jar lids of various sizes (metal or plastic)
plastic straws
metal file or metal sandpaper
hand drill with a small bit to make holes in plastic lids
saw

miter box
C-clamps 3-inch or larger to hold miter box in place
hammer
flat-headed upholstery tacks 1/2–3/4-inch or small nails with heads for pulley axles
large rubber bands for belts (medium weight)
string
Student Page 2.7.10 BELTS AND PULLEYS

PRODUCTS

Pulley systems
Completed Student Pages

PROCEDURES

1. **Have the students review the differences between trikes and bikes.**

   Ask such questions as these:
   - How is the way that you move the wheel on a bike different from the way you move the wheel on a trike?
     ✔ Work from the idea that on a trike you move the front wheel with pedals directly connected to it. On a bike, a sprocket attached to the back wheel is turned by a chain connected to a front sprocket. The pedal is attached to the front sprocket.
   - How is the trike different from the bike when you make one round of a pedal?
     ✔ Get at the idea that with each complete turn of the trike pedal the wheel turns once. With each complete turn of the bike pedal the wheel turns several times.
   - What direction does the sprocket on the wheel of the bike turn when compared to the direction the pedals turn? The same way? A different way?
     ✔ Test using a bike to verify that it is the same direction.

2. **Introduce the making of pulley boards. See Figure 2.7.10(1).**

   Review or demonstrate the following
   - How to use a miter box, saw, hammer, drill, and other tools.

- How to find the centers of lids.
  ✔ Trace the lid on paper. Cut the tracing out and fold in half, then in quarters. Place the folded template on the wheel. The center will be at the tip of the center folds.

- That the lids must turn freely and not wobble.

3. **Have small groups of students make pulley boards.**

   Help them do the following
   - Make two pulleys of the same size.
     ✔ Have the students drive nails through the center of metal lids and sand away the burs so the lids turn freely. Pre-drilled plastic lids can also be used.
   - Use the Inventor's Box to invent a way to connect one pulley so it will turn the other.
     ✔ Work to the use of rubber bands, string, and so forth.

   - Share their inventions.

4. **Have the students carry out Investigation 1 about the direction belt-connected pulleys turn. Have them report their results on Student Page 2.7.10 BELTS AND PULLEYS.**

   Have them
   - Connect two pulleys of the same size with a belt. See Figure 2.7.10[1].

   - Predict which direction a pulley will turn when they turn the pulley it is connected with clockwise. Counterclockwise.
     ✔ This is an opportunity for a quick review of the analog clock and the direction its hands move.

   - Test their predictions and help them record what actually happened using the drawing on Student Page 2.7.10.

   - Share their findings.
     ✔ Work to clear descriptions so it is obvious that the students are seeing and saying the same things.

5. **Have the students carry out Investigation 2 about the relative number of times belt-connected pulleys of the same size turn. Have them record their predictions and observations on Student Page 2.7.10.**

Have them
- Use the two pulleys of the same size and connect them with a belt as before.
- Predict the number of times one pulley turns another of the same size when they are connected by a belt. Turn one pulley clockwise one turn. Counterclockwise one turn.
- Test their predictions and record what actually happens.
- Share their findings and descriptions so it is obvious that the students are seeing and saying the same things.

6. **Have the students carry out Investigation 3 by inventing a way to connect pulleys with a belt and get the pulleys to go in opposite directions. See Figure 2.7.10(2). Have them record their predictions and results on Student Page 2.7.10.**

7. **Have the students carry out Investigation 4 by inventing a way to connect pulleys on opposite sides of the board with a belt so that one pulley drives the other. See Figure 2.7.10(3). Have them record their predictions and results on Student Page 2.7.10.**

   Ask such questions as these:
   - How did you connect your pulleys?
   - In what direction or directions did the pulleys move?
     ✔ If the pulleys have been connected as shown in Figure 2.7.10[3], they will move in opposite directions.
   - Can anyone invent a way to go around corners so that the rubber bands are not worn badly?
     ✔ Get at such things as smoothing the edges of the board, using straw bumpers or wheels, and so forth to reduce friction.
   - Can everyone get two pulleys on opposite sides of the board to move in the same direction?
     ✔ If the belt is crossed or twisted once, as in Investigation 3, the pulleys will move in the same direction.

8. **Give the students a challenge set of construction problems and have them share their solutions.**

Include such questions as these:

- What is the smallest number of pulleys of the same size that can be connected in a circle of three or more so all the pulleys move?
- Will any number of pulleys work?
- Can you make a system with pulleys in a circle where every other pulley goes the opposite direction?
- Can you get the pulleys on opposite sides of the board moving in the same direction without using a belt?
  ✔ They might drill a hole through the board and attach the lids on either side to an axle.

9. **Have the students freely explore to solve their own problems.**

Help them do the following

- Make and record predictions before testing.
- Share their findings and discoveries about their systems.

EXTENSION

- Make a class chart about pulleys and belts and have the students report on how pulleys and belts are used in devices they find.

ILLUSTRATIONS

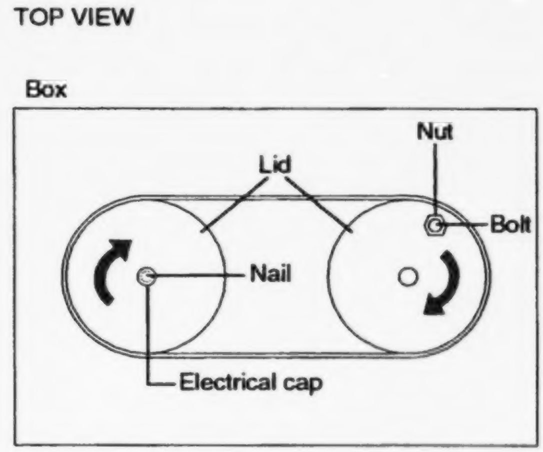
TOP VIEW
Box
Nut
Lid
Bolt
Nail
Electrical cap

Figure 2.7.10(1) Pulley system with pulleys turning in the same direction.

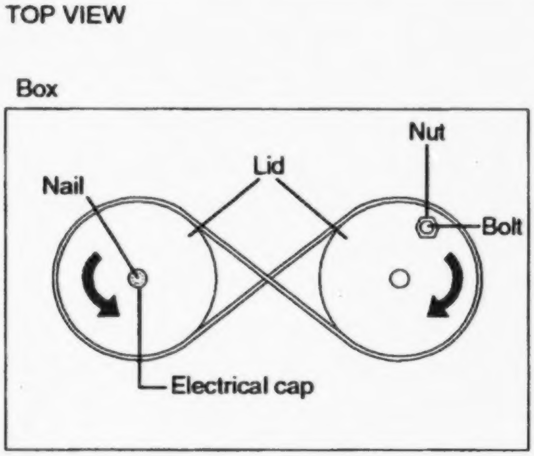
TOP VIEW
Box
Nut
Lid
Nail
Bolt
Electrical cap

Figure 2.7.10(2) Pulley system with pulleys turning in opposite directions.

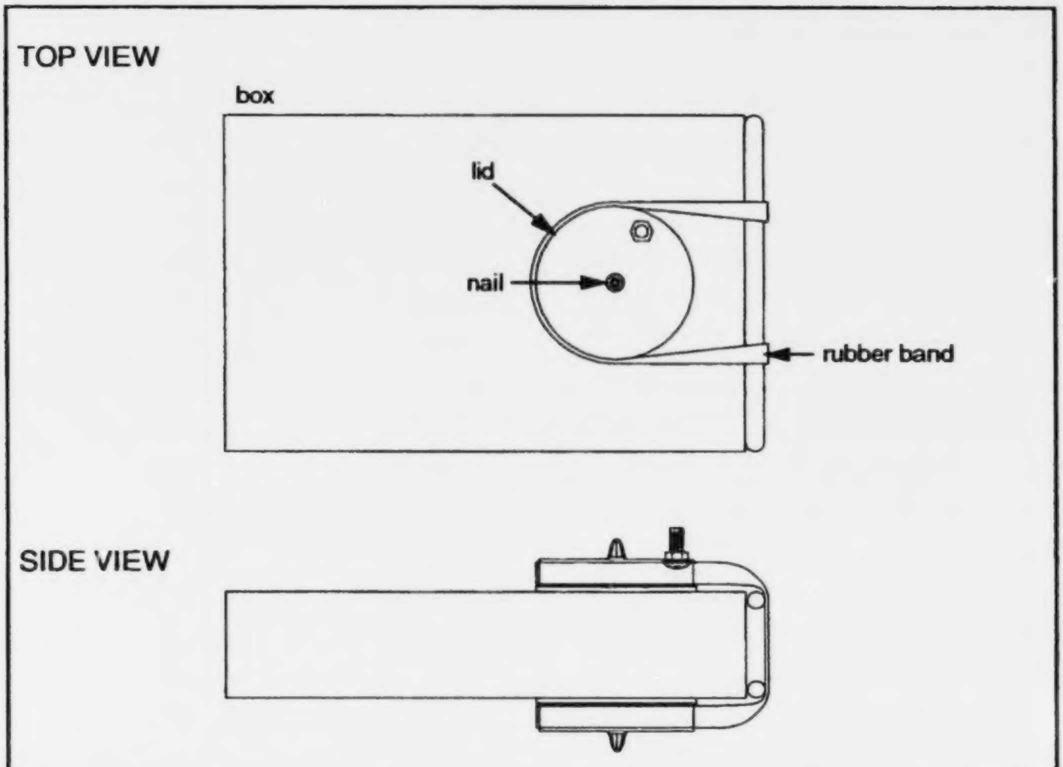
TOP VIEW
box
lid
nail
rubber band
SIDE VIEW

Figure 2.7.10(3) Pulley system with the top pulley driving the bottom pulley.

2.7.11 FAST AND SLOW PULLEYS

OBJECTIVES

- Assemble different pulley combinations of large and small pulleys.
- Make and test predictions about the relative number of times one pulley will drive another.
- Invent complex pulley systems.

BACKGROUND

This activity follows Activity 2.7.10 BELTS AND PULLEYS and precede 2.7.12 GEARS AND WHEELS. In FAST AND SLOW PULLEYS the students explore driving large pulleys with small pulleys and small pulleys with large pulleys. The activity provides an explanation of the anomaly of the relative distance traveled by bikes and trikes per complete rotation of the pedals. It also provides further insights into how a slow-moving pulley can drive a fast-moving pulley. The students modify the pulley boards from Activity 2.7.10 BELTS AND PULLEYS.

Straws, lids, and pulleys

A stiff plastic straw slipped over a nail makes a good small pulley. The students should check to be sure the straw pulley turns freely on the nail. A pointer can be invented to help count its of turns. A toothpick taped to the straw works well. See Figure 2.7.11(1).

A *combination pulley* can be made by attaching a large lid to a small lid so that they use a common axle. Then pulley combinations such as a large pulley driving a small pulley glued to a large pulley that drives another small pulley can be made. These systems of pulleys can produce a spectacular number of turns in the last pulley in the system. See Figure 2.7.11(2). Use a hot-glue gun to bond the two lids together. Pulleys can also be wired together. Then put a center hole through both lids with a drill or nail and hammer for the axle.

A metal lid can be slid over a straw to make a combination pulley one of which is relatively large and the other quite small. A hole in the center of the lid made with a twelve penny nail has rough edges. These edges will grasp the straw, keeping the lid from slipping. See Figure 2.7.11(3).

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Counting the turns of pulleys
The students may invent several ways of counting the number of turns a pulley makes. One simple method is for the student to mark the pulley and the board and count the number of times the mark on the pulley passes the mark on the board. They can use tape or marking pens.

STUDENT ROLES

Physicist
Inventor
Engineer

MATERIALS

bicycle with a derailer gearshift (gearshift with multiple external sprockets) if possible
tricycle
pulley boards from Activity 2.7.10
  scrap lumber to make pulley boards 1 in x 6 in x 12 in (or larger and/or thicker)
sixpenny nails to punch axles
twelve penny nails to make holes for straws
6-in nails to hold straw pulleys
jar lids of various sizes (metal or plastic)
stiff plastic straws
sandpaper
hand drill with a small bit to make holes in plastic lids
hot-glue gun to glue lids together or wire to wire lids together
saw
hammer
3/4 and 1 1/2-inch flat-headed upholstery tacks or nails with heads for pulley axles
large rubber bands for belts (medium weight)
string
marking pens
tape
Student Page 2.7.11 FAST AND SLOW PULLEYS

PRODUCTS

Pulley systems
Completed Student Pages

PROCEDURES

1. **Review what has been observed about trikes and bikes and belts and pulleys.**

   Ask such questions as these:
   - How did you connect belts so that two pulleys would go in the same direction?
     ✔ Have a student demonstrate on a pulley board.

   - How did you connect belts so that two pulleys would go in opposite directions?
     ✔ Have a student demonstrate on a pulley board.

   - How could you arrange pulleys so that they would look more like the sprockets and chain of a bike?
     ✔ Have the students look at a bike's sprockets. Work for the idea that they need a pair of pulleys, one large and one small.

2. **Have the students use the pulley boards from Activity 2.7.10 BELTS AND PULLEYS to make a system with a large pulley and a small pulley. Have them invent ways to count the number of times a small pulley goes around compared to the number of times a larger pulley connected with a belt goes around. Help them explore the system. Have them report their results on Student Page 2.7.11 FAST AND SLOW PULLEYS.**

   Ask such questions as these:
   - How did you count the number of turns that the small pulley made for one turn of the large pulley?
     ✔ Work for some way to know when the wheel has made a complete turn.

   - What generalizations can you make about the number of turns a large pulley makes compared to a smaller pulley with a belt?
     ✔ Work to the ideas that the large wheel will turn fewer times than the smaller wheel and conversely, the small pulley will turn more times for one turn of the large pulley..

3. **Have the students apply their understanding of pulleys to bikes and trikes.**

Ask such questions as these:

- When you look at one turn of the pedals of a trike and a bike, what is the advantage of the bike over the trike?
  ✔ Work to the idea that you can get the bike wheel to turn several times for each complete rotation of the pedals. For one rotation of the pedals the trike wheel turns only once. Review this while observing a bike and a trike.

- Which is easier to turn on a bike, a small sprocket that turns a bigger sprocket or a big sprocket that turns a smaller sprocket?
  ✔ Work for agreement that it is easier to turn the small sprocket that turns the bigger sprocket just as it is easier to turn the small pulley that turns the bigger pulley.

4. **Demonstrate first how to make a small pulley from a straw and nail and then how to make a combination pulley by gluing or wiring together a large and small lid and/or slipping a metal lid over a straw. See the Background.**

5. **Give the students a challenge set of construction problems and have them share their solutions.**

Include such things as the following

- How fast can you make a system of pulleys go?
  ✔ Several single or combination pulleys can be put in a row to drive each other so that large pulleys drive smaller pulleys.

- How slow can you make a pulley system go?
  ✔ Several single or combination pulleys can be put in a row to drive each other so that smaller pulleys drive larger pulleys.

- How many different pulleys can be put in a connected system with each turning a different number of times?
  ✔ Ask how you know they are turning a different number of times. Ask what limits the number of pulleys you can use.

6. **Have the students explore different pulley arrangements of their own design.**

For each system have the students predict the following

- Which way the pulleys will turn.

- Which pulleys will go the fastest and/or slowest.

7. **To summarize, have each group show their most interesting pulley system and explain how it works.**

   Have the class predict the following
   - How the pulleys will turn.

   - Which pulleys will turn the most number of times.

EXTENSION

- Post a challenge asking the students how they could predict how far a real bicycle will go with one turn of the pedal. They will need to know (a) the distance around the rear wheel (its circumference) and (b) the number of turns the rear wheel makes with one complete turn of the pedals. The circumference of the wheel can be marked on the floor and measured with a meter-string can.

ILLUSTRATIONS

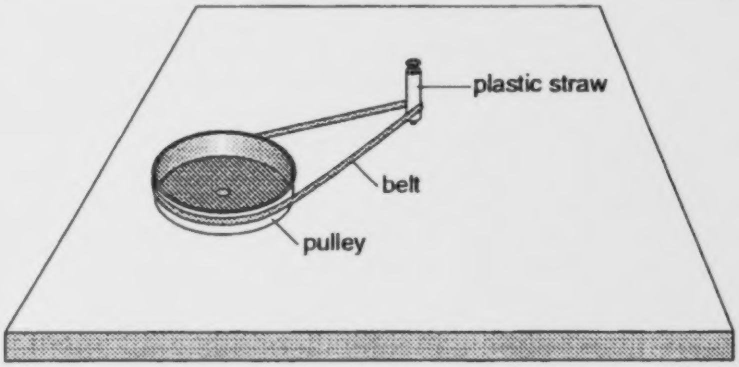

Figure 2.7.11(1) Large pulley driving a small straw pulley.

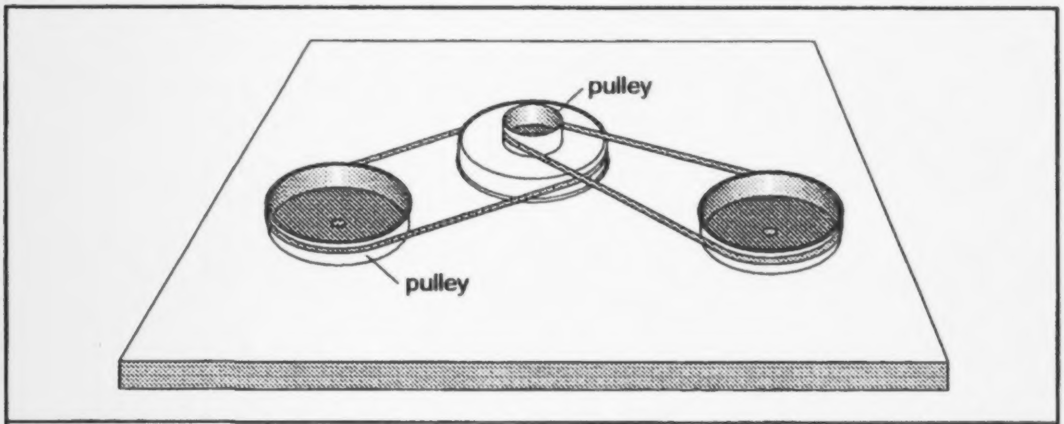
pulley
pulley

Figure 2.7.11(2) Large pulley driving a combination pulley attached to a second large pulley.

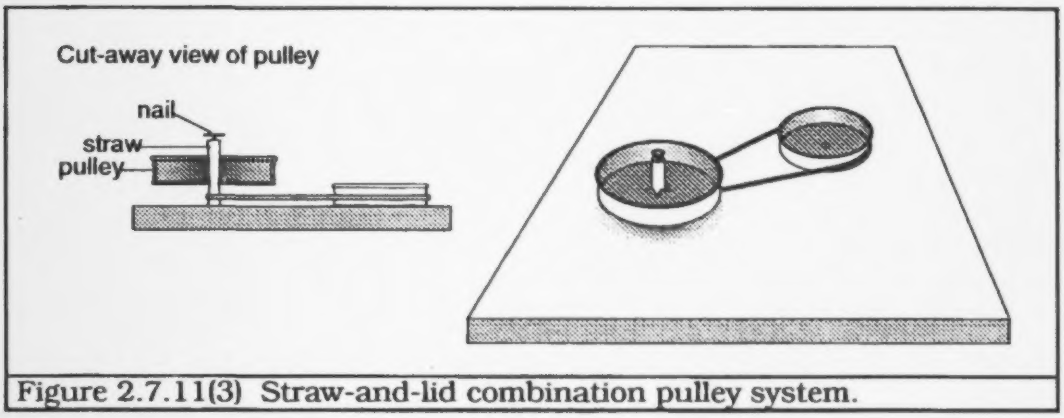
Cut-away view of pulley
nail
straw
pulley

Figure 2.7.11(3) Straw-and-lid combination pulley system.

DASH 2.7.12 GEARS AND WHEELS

OBJECTIVES

The students
- Assemble different wheel combinations.
- Make and test predictions about the number of times one wheel will drive another.
- Make and test predictions about the direction one gear will drive another.

BACKGROUND

This activity follows Activities 2.7.10 BELTS AND PULLEYS and 2.7.11 FAST AND SLOW PULLEYS. Up to this point the students have studied pulley wheels that are connected to each other by belts. Here they study wheels that are in direct contact with each other. Wheels in contact with each other operate the same way as gears but somewhat differently from pulleys and belts and sprockets and chains.

GEARS AND WHEELS provides a continuing study of what happens when large wheels are driven by small wheels and small wheels are driven by large wheels. Most important the students observe the direction of wheel rotation, how that direction can be changed, and relative speeds of rotation.

Gears and Wheels

Gears are specialized wheels with teeth very much like the sprockets that drive a chain. Where sprockets are designed to engage the links in a chain, gear teeth are designed to engage each other. Wheels that come in contact with each other, or rub against each other, drive each other because of friction. Further, they operate the same way engaged gears drive each other. When one wheel or gear turns, the other wheel or gear turns. Because wheels and gears work the same way and because gears are difficult to make, we will use wheels or *toothless gears* in this investigation.

Making Wheels

The same lids that were used for pulleys can be used for wheels. To reduce the slippage when the wheels contact each other, wrap rubber

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bands around the rims or wrap a piece of electrical or masking tape around them. It will be difficult to get two wheels to come in contact by nailing them to a board. Therefore it is suggested that students simply hold one wheel against another or use the floating axle described below.

Floating Axle
Wheels on the pulley board can be kept in contact with each other using the floating axle shown in Figure 2.7.12(1). Open a large paper clip into a straight wire. Bend one end of the paper clip around a nail and bend the other end into an axle for a wheel. The wheel on the paper clip axle can then be swung into contact with another wheel. The wheel with the floating axle can be held against the other wheel with a rubber band. Several of these floating axles can be used at once.

STUDENT ROLES

Physicist
Inventor
Engineer

MATERIALS

pulley boards from Activity 2.7.10
sixpenny finishing nails
eight penny finishing nails
1-1/2-inch screws and nuts for handles on driver pulleys (*optional*)
jar lids of various sizes
plastic straws
metal file or sandpaper
saw
large paper clips to make floating axles
pliers
hammer
flat head upholstery tacks for axles
rubber bands to wrap wheels and for floating axles
electrical or masking tape
Student Page 2.7.12 GEARS AND WHEELS

PRODUCTS

Gear-like wheel systems
Completed Student Pages

PROCEDURES

1. **Review work with belts and pulleys.**

   Ask such questions as these:
   - How did you connect belts so that two pulleys would go in the same direction?
     ✔ Have a student demonstrate.
   - How did you connect belts so that two pulleys would go in opposite directions?
     ✔ Have a student demonstrate.
   - How do you think wheels turn when in contact or touching each other?
     ✔ Show two wheels in contact with each other.

2. **Help the students transform their pulleys from Activity 2.7.10 BELTS AND PULLEYS into wheels. Wrap rubber bands or tape on the rim of pulleys. Demonstrate how to make a floating axle if used. See Figure 2.7.12(1).**

3. **Help the students carry out Investigation 1.**

   Have them
   - Attach a wheel to the board checking to be sure that it moves freely. Bring a second wheel of the same size in contact with the drive wheel.
     ✔ This second wheel may be on a floating axle or hand held.
   - Predict what direction the second wheel will be turned when they turn the drive wheel clockwise. Record predictions on Student Page 2.7.12 GEARS AND WHEELS.
   - Test their predictions and record what actually happens.
     ✔ The wheels go in opposite directions.
   - Predict what will happen when the direction of the drive wheel is reversed—goes counterclockwise.
     ✔ The wheels change direction but still go in opposite directions.
   - Predict how many times the second wheel will turn for each turn of a drive wheel of the same size.
     ✔ The wheels will turn the same or about the same number of times.

- Discuss the role of *friction* in the operation of the wheels.
- Share their findings and work for clear descriptions so students are seeing and sharing the same ideas.

4. **Have the students carry out Investigation 2.**

Have them
- Use wheels of different sizes.
- Record their predictions about the number of turns the second wheel will make.
- Test their predictions and record what happens.
- Share the findings about their systems.
- Make generalizations about larger wheels driving smaller wheels.
  ✔ Work to the idea that the small wheel will turn more times than the large wheel.
- Make generalizations about small wheels driving larger wheels.
  ✔ Work to the idea that the large wheel turns fewer times than the small wheel.
- Make generalizations about the direction of rotation of wheels that are in contact with each other.
  ✔ Work to the idea that the wheels turn in opposite directions.

5. **Have the students carry out Investigation 3. Have them invent a way to connect gears on opposite sides of the board. See Figure 2.7.12(2).**

Ask such questions as these:
- How did you connect your wheels?
- Which direction did the wheels move?

6. **Give the students a challenge set of construction problems. Have them share their solutions.**

Some suggested challenges
- Can you make a circle of connected wheels of the same size that will all turn? If so, what is the smallest number of wheels of the same size that can be connected in a circle so all wheels turn?

- Will both odd numbers of wheels and even numbers of wheels in the circle turn?
- Can you make a system with wheels of two different sizes and connect them in a circle so that all the wheels turn?

7. **Have the students explore freely.**

   Have them
   - Make and record predictions about directions of rotation and relative speeds of rotation before testing what happens.
   - Share their systems and discoveries.

8. **Have the students demonstrate the most interesting wheel combinations they have made.**

EXTENSIONS

- Make a class chart about gears and wheels. Have the students report on examples they find and how the gears and wheels are used.
- Have the students find or invent toothed gears. Have them compare the directions and relative speeds of *toothed* gears systems with *toothless* wheel systems.
  ✔ Toothed gears come *ready-made* as lids on certain coffee jars and caps of clear 35 mm film canisters.

ILLUSTRATIONS

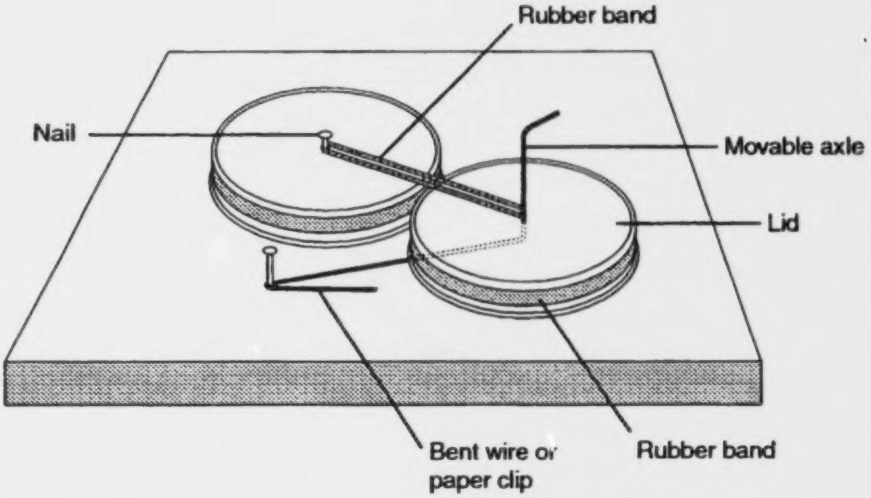

Rubber band
Nail
Movable axle
Lid
Bent wire or paper clip
Rubber band

Figure 2.7.12(1) Wheel with floating axle.

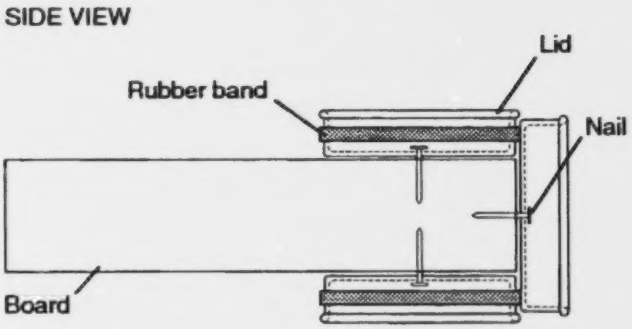

SIDE VIEW
Lid
Rubber band
Nail
Board

Figure 2.7.12(2) Wheel turning wheels on opposite side of board.

DASH

TRANSPORTATION SYSTEMS SP 2.7.1

Name: ____________________

Date: ____________________

NUMBER	TRANSPORTATION SYSTEMS
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

SP 2.7.2

DASH

MAKING A RACE CAR
SP 2.7.2

Name: ______________________

Date: ______________________

Draw and label a side and top view of your car.

DASH

RAMP DESIGN
SP 2.7.3A

Name: ______________________

Date: ______________________

Draw and label your design for a ramp.

DASH

**RACE RESULTS
SP 2.7.3B**

Name: ______________________

Date: ______________________

RACE NAME:

RACE TEAM	RACE NUMBER	TIME	DISTANCE

SP 2.7.4A

DASH

SOFT-SURFACE RAMP DESIGN SP 2.7.4A

Name: ______________________

Date: ______________________

Draw and label your idea for a ramp.

SP 2.7.4B

DASH

SOFT-SURFACE RACE
SP 2.7.4B

Name: ______________________

Date: ______________________

SOFT-SURFACE RACETRACK:

RACE TEAM	RACE NUMBER	TIME	DISTANCE

SP 2.7.5A

DASH

VILLAGE PLAN IDEAS
SP 2.7.5A

Name: ______________________

Date: ______________________

STREETS

___ 4-lane street with sidewalks
___ 4-lane street without sidewalks
___ 2-lane street with sidewalks
___ 2-lane street without sidewalks
___ one-way streets
___ intersection with 4-way light
___ intersection with 4-way stop
___ intersection with 2-way light
___ intersection with 2-way stop
___ intersection with 2-way yield
___ school crossings

You need a house and garage or apartment with parking for each car.
How many houses? ___
Apartments? ___

BUILDINGS

___ shopping center with parking lot
___ school with parking lot and bus park
___ church with parking lot
___ police station with parking lot
___ hospital with parking lot
___ fire station
___ fast food with drive-through and parking lot
___ post office with parking lot
___ city hall with parking lot
___ library with parking lot
___ gas station
___
___

SIGNS AND LIGHTS

___ stop
___ yield
___ street signs
___ 4-way lights
___ one way
___ no entry
___ dead end
___ speed limit
___ school crossing

OTHER IDEAS

DASH

VILLAGE PLAN SIZES
SP 2.7.5B

Name: ____________________

Date: ____________________

VILLAGE	SIZE
Whole village	Length: Width:
4–Lane streets	Width:
2–Lane streets	Width:
Sidewalks	Width:
Blocks	Length: Width:

DASH

VILLAGE PLAN
DESIGN
SP 2.7.5C

Name: ______________________

Date: ______________________

SP 2.7.6A

DASH

VILLAGE MAP
SP 2.7.6A

Name: ______________________

Date: ______________________

DASH

PICK UP AND DELIVERY
SP 2.7.6B

Name: ______________________

Date: ______________________

NUMBER	INSTRUCTIONS
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

DASH

PICK UP AND DELIVERY
SP 2.7.7

Name: ____________________

Date: ____________________

NUMBER	INSTRUCTIONS
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

DASH

TRAVEL PLAN
SP 2.7.8

Name: ____________________

Date: ____________________

NUMBER	INSTRUCTIONS
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

DASH

TRIKES AND BIKES
SP 2.7.9

Name: ______________________

Date: ______________________

HOW FAR I WALK IN TWO STEPS	
HOW FAR THE TRIKE GOES IN TWO STEPS	
HOW FAR THE BIKE GOES IN TWO STEPS	
DISTANCE AROUND TRIKE WHEEL	
DISTANCE AROUND BIKE WHEEL	

SP 2.7.10

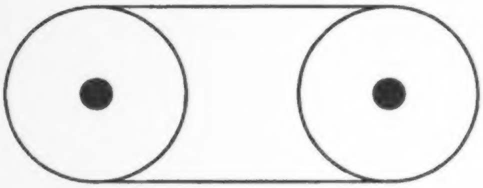
DASH

BELTS AND PULLEYS
SP 2.7.10

Name: ____________________

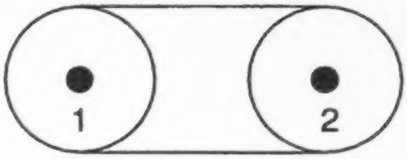
Date: ____________________

INVESTIGATION 1



Draw arrows to show how the pulleys move.

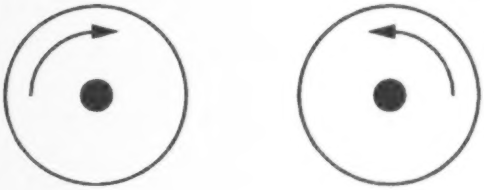
INVESTIGATION 2



NUMBER OF TURNS

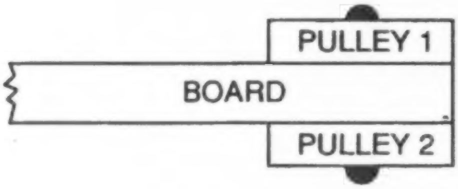
PULLEY 1	PULLEY 2	
	PREDICTION	OBSERVATION

INVESTIGATION 3



Show how you connected the pulleys so they moved in opposite directions.

INVESTIGATION 4



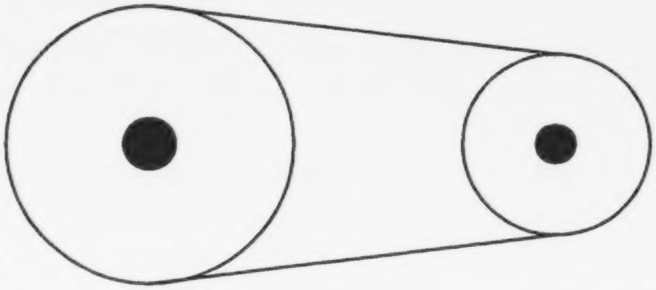
Show how you connected your pulleys.

DASH

FAST AND SLOW PULLEYS
SP 2.7.11

Name: ______________________

Date: ______________________



BIG PULLEY TURNS	SMALL PULLEY TURNS
1 TURN	

Fill in the blanks.

A big pulley connected to a small pulley makes the small pulley go around ____________ times than the big pulley.

A small pulley connected to a big pulley makes the big pulley go around ____________ times than the small pulley.

It's easier to turn a ____________ pulley than it is to turn a ____________ pulley.

SP 2.7.12

DASH

GEARS AND WHEELS
SP 2.7.12

Name: ______________________

Date: ______________________

INVESTIGATION 1

Draw arrows to show the directions the wheels turn.

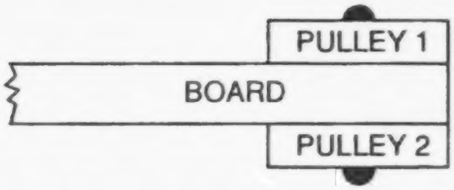
PREDICTION	OBSERVATION

INVESTIGATION 2

How many times does Wheel 2 turn?

CLOCKWISE		COUNTERCLOCKWISE	
PREDICTION	OBSERVATION	PREDICTION	OBSERVATION

INVESTIGATION 3



Show how you connected your wheels. Draw arrows to show how they move.

DASH

GRADE 2
CLUSTER 8

Energy and Communication

2.8.1 Camera Obscura

2.8.2 Mirrors and Sunlight

2.8.3 Clouds and Sunlight

2.8.4 Comparing Temperatures

2.8.5 Eclipses

GRADE 2
ACTIVITY GOALS

CLUSTER 8
Energy and Communication

2.8.1 Camera Obscura

To build and use a camera obscura; to observe the inversion of images in a camera obscura; and to develop construction, observation, interpretive, problems solving, and reasoning skills.

2.8.2 Mirrors and Sunlight

To explore how to control sunlight using mirrors; to explore reflection and light; and to develop observation and reasoning skills.

2.8.3 Clouds and Sunlight

To develop hypotheses about how shadows are formed; to develop hypotheses about how cloud shadows affect temperature; to experiment and test hypotheses; and to develop temperature reading, hypothesis forming, experiment invention, observation, interpretation, and reasoning skills.

2.8.4 Comparing Temperatures

To study temperature change through the day; to study temperature change over the seasons; to develop a way to finding averages using a timeline and string; and to develop temperature reading, prediction, data collection, observation, interpretation, and reasoning skills.

2.8.5 Eclipses

To observe all eclipses of the sun and moon; to use a camera obscura; to begin to correlate eclipses with moon phases; and to develop observation, interpretation, and reasoning skills.

2.8.1 CAMERA OBSCURA

OBJECTIVES

The students
- Build a camera obscura.
- Modify their camera as they use it.
- Observe that the image is inverted on the camera obscura screen.

BACKGROUND

This activity should precede Activities 2.8.2 MIRRORS AND SUNLIGHT, 2.8.3 CLOUDS AND SUNLIGHT and 2.8.5 ECLIPSES where the camera is used in observing the sun. In CAMERA OBSCURA the students build a camera obscura and test its characteristics.

Making a Camera Obscura

Any cardboard box at least 2-3 feet long and wide enough and tall enough for a student to get their head inside can be used. To construct a camera, tape a white paper screen to one of the small ends on the inside of the box. Label or mark the screen end on the *outside* of the box. Completely seal the box to prevent light from entering. Cut a hole in the bottom of the box at the end opposite the screen to fit the largest head in the class. Duct tape the bottom of a black or dark colored T-shirt around the hole to keep light from entering. Make a hole with a nail or ice pick in the side of the box at the end opposite the screen near the top. Light will go through this hole and fall on the screen. This small hole can be enlarged with a pencil if needed. See Figure 2.8.1.

Using the Camera

When the students first put their head in the camera it will appear dark. Slowly the eyes will accommodate to the dark and an image will appear on the screen. This will take a minute or so. By increasing the size of the hole in the camera more light will enter and the image will appear more quickly. However, the larger the hole the less clear the image.

The image that the students will see will be *upside down.* This is an arresting anomaly and subject for the Wonder and Discover Book that will continue to tease students until studies of light and lenses in DASH 5. The image will appear *in color* if the students are patient.

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Tracing an Image
The camera obscura is a pinhole camera and will cast a sharp image no matter what its focal length so long as the pinhole is just that, a *pin*hole. Since it casts an image on a screen, the students can trace the image. The further the screen is from the hole in the box the larger the image will be. If images are to be traced, a second hole will need to be made for the drawing hand near the screen end of the box. A sleeve from an old shirt or a sock taped to the hole will act like the T-shirt to keep out the light.

STUDENT ROLE

Astronomer

MATERIALS

large cardboard box for each camera
white paper screen
T-shirt (black or dark colored), one per camera
black construction paper strips
masking tape
duct tape
universal scissors to cut the cardboard—if using a razor blade cutter, the teacher or an adult should do the cutting
ice pick, awl, or nail
Student Page 2.8.1 CAMERA OBSCURA

PRODUCTS

Camera obscuras

PROCEDURES

1. **Help the students construct a camera obscura using Student Page 2.8.1 CAMERA OBSCURA as a reference.**

   Help them
   - Tape a white paper screen on the inside of one of the small ends of the box.
     ✔ Label the screen end on the *outside* of the box.

469

- Seal the box to prevent light from entering.
  ✔ Black paper strips covered by duct tape block out the light well.

- Cut a head-sized hole near the end of the box opposite the screen.
  ✔ The hole should fit the largest head in the class. This may be the teacher's.
  ✔ This is an operation that the teacher should control if razor blade cutters are used. Universal scissors are a safer alternative.

- Tape down any loose flaps inside the box.

- Duct tape the bottom of a black or dark colored T-shirt around the hole to keep light from entering the camera.
  ✔ Head goes through the neck hole of the shirt into the box. The *bunched up* shirt will keep light from entering the hole.
  ✔ Dark colored cloth or towels may also be used.

- Make a hole with a nail through the side of the box opposite the screen.
  ✔ This should be above and to the side of the head's location so light can go above and around the head to fall on the screen.

2. **Have the students test their cameras outdoors on a sunny day.**

Help them

- Find the image of well lit objects using the camera.
  ✔ Aim the light hole toward the object.
  ✔ If light is leaking into the box, recover the spots or seams with black paper and tape.
  ✔ Encourage students to be patient. The image will appear. Color takes a bit longer.
  ✔ Indoors a trouble light can be used. Cloudy days work too.

- Explore, observing what happens to the image on the screen.

- Observe the sun on their screen and describe what they see.

- Try boxes with different distances between the light hole and the screen. Ask what happens to the size of the image of an object in boxes with different distances.
  ✔ Test out boxes with a hand hole, moving a screen nearer and farther from the light hole.
  ✔ This can be done inside using a trouble light.
  ✔ The image will be larger in longer boxes.

3. Help the students summarize their findings.

Ask such questions as these:

- What happens to the image as the screen is moved closer to the pinhole? Farther away from the pinhole?
  ✔ Get at the idea that as it gets closer to the pinhole it gets smaller.

- How might you modify your camera to get a larger image?
  ✔ Get at such ideas as making the camera box longer

- How might you modify your camera to get an even better image of the world outside?
  ✔ A smaller light hole will project a clearer image.

EXTENSION

- Have the students read about the camera obscura and how it has been used in the past.

ILLUSTRATION

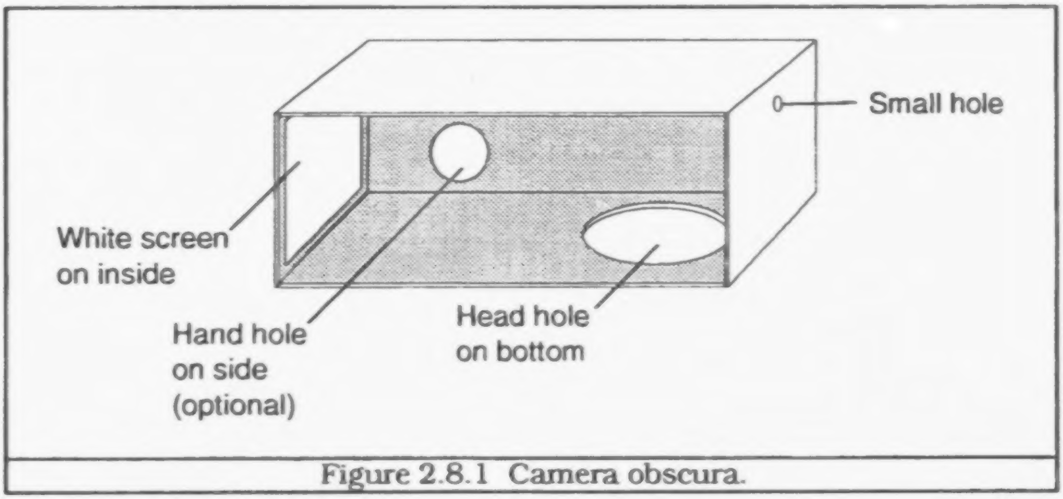
Small hole
White screen on inside
Hand hole on side (optional)
Head hole on bottom

Figure 2.8.1 Camera obscura.

2.8.2 MIRRORS AND SUNLIGHT

OBJECTIVES

The students
- Explore directing sunlight with mirrors.
- Make aluminum foil mirrors.
- Direct light at selected targets.
- Generalize about mirrors reflecting sunlight.

BACKGROUND

This activity should follow 2.8.1 CAMERA OBSCURA. In MIRRORS AND SUNLIGHT the students make a concept map about sunlight. They then investigate the way sunlight is reflected by mirrors.

Making Mirrors

Mirrors can be made from smooth aluminum foil. These foil mirrors will not reflect as well as glass or plastic mirrors, but they will work sufficiently well for investigations here. Their poor quality is part of the inquiry.

Caution—The students should not look directly at the sun, nor should they reflect light onto another person's face.

STUDENT ROLE

Optical physicist

MATERIALS

aluminum foil
scissors
cardboard
cellophane tape
small hand mirrors, plastic or glass
model aluminum-foil mirror

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chart paper
markers
Student Page 2.8.2 MIRRORS AND SUNLIGHT

PRODUCTS

Concept map about sunlight
Aluminum foil mirrors
Completed Student Pages

PROCEDURES

1. **Help the students make a concept map about sunlight.**

   Help them include such things as
   - Sunlight comes from the sun.
   - Sunlight can hurt their eyes.
   - The sun lights the world so you can see in the daytime.
   - Sunlight is necessary for plants.
   - Sunlight warms the earth.

2. **Introduce the students to directing sunlight with mirrors.**

   Ask such questions as these:
   - When you face the sun, where is your shadow?
   - When you face the sun, is your shadow ever in front of you? Why?
     ✔ Work to the ideas that sunlight seems to go in one direction and you block the sun from getting where it would go if you were not in the way.
   - Does sunlight seem to travel in a straight or curved line?
   - When you face the sunlight, can you get the sunlight on your back? How?
     ✔ Work to the idea of using a mirror.

3. **Help the students make aluminum foil mirrors. Show them an example.**

Have them
- Each construct an aluminum foil mirror 2–3 inches on a side. ✔ Aluminum can be folded around a piece of cardboard to hold its shape.

- Test their aluminum foil mirrors, comparing them with conventional mirrors.

4. **Have the students work in small groups to direct light at selected targets.**

Target A: A point directly in front of them when they face the sun. Have them use both a conventional mirror and their foil mirrors.
Ask such questions as these:
- How did you have to hold the mirror to get the light to hit the target?

- Is it easier to hit a target that is nearby or far away? Why?

- Is the spot of light made by an aluminum foil mirror the same size as a spot of light made by a conventional mirror?

- Which is brighter?

- Which is the better mirror? What do you mean by better? ✔ Work to the idea that the conventional mirror gives a brighter reflection. At a distance the aluminum-foil mirror spreads out the light into a circle of light.

Target B: A point to the right when facing the sun.
Ask:
- How did you have to hold the mirror to get the light to hit the target? ✔ Work to the idea that it angled to the right.

Target C: A point to the left when facing the sun.
Ask:
- How did you have to hold the mirror to get the light to hit the target?

Target D: A point behind the observer when facing the sun.
Ask:

- How did you have to hold the mirror to get the light to hit the target?

Target E: A point through a classroom window and onto a wall.

- How did you solve the problem?

5. **Help the students explore freely with sunlight and mirrors. As they explore give them some challenges.**

   Some possible challenges
   - How many times can you change the direction of the same beam of light?
   - What happens to the light when a foil mirror gets crinkled?
   - Are there places where you cannot cast a reflected beam of light with your mirror. If so where are they?

6. **Help the class generalize about mirrors and sunlight. Help them complete Student Page 2.8.2 MIRRORS AND SUNLIGHT.**

   Ask such questions as these:
   - How did you change the direction of sunlight using mirrors?
     ✔ Introduce the term *reflection* if it has not been used already.
   - Does sunlight travel in straight or curved lines? Why do you say that?
   - What new ideas from your study of mirrors should be added to your concept map about sunlight?

EXTENSION

- Have the students find and test other materials that can be made into mirrors in addition to silvered glass or plastic and aluminum foil.

2.8.3 CLOUDS AND SUNLIGHT

OBJECTIVES

- Observe the formation of shadows by clouds.
- Hypothesize about temperature in a cloud's shadow and in sunlight.
- Find temperatures under cloud cover or shadow and in sunlight,.

BACKGROUND

This activity can be started any time after 2.8.1 CAMERA OBSCURA. CLOUDS AND SUNLIGHT is designed to help students become aware that there is a difference in temperature in sunlight and under cloud cover. Here they observe the capacity of clouds to make shadows when they block the sunlight. Then they hypothesize about the temperature difference between sunlit and shadowed areas and test their hypotheses.

STUDENT ROLE

Meteorologist

MATERIALS

Celsius thermometers
camera obscuras from Activity 2.8.1 CAMERA OBSCURA
Student Page 2.8.3 CLOUDS AND SUNLIGHT

PRODUCTS

Completed Student Pages

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PROCEDURES

1. **Introduce the activity on a day when small clouds are passing overhead. Go outside with the students and have them observe the clouds and the shadows clouds make. Have them set up their camera obscuras for viewing the sun. Help them align their cameras. When the image of the sun is on their screens, have the students observe what happens as clouds cover the sun.**

   Ask such questions as these:

   - What did you see as a cloud passed by?
   - Which was closer to you, the cloud or the sun? Why do you think so?
   - What did the edge of the cloud look like on the screen?
   - What happened to the picture on the screen when the sun was blocked? Why might this be so?
     ✔ Work toward the idea of the screen getting darker because there was less light.
   - What happened to the light on the ground when the sun was blocked?
     ✔ Work toward the idea of the ground getting darker.
   - How do you make a shadow with your bodies?
     ✔ Work toward the idea that they make a shadow by blocking light.
   - Can you see your shadow in the dark? Why?
     ✔ Work toward the idea that there is no light to block so bodies are not outlined in light.
   - Can you see your own shadow when the sun is blocked by clouds? Why?
     ✔ When the clouds block the light there is no light to be blocked or light to make a shadow.
   - Can you see the shadow of trees, buildings, and other objects when the sun is blocked by clouds? Why?
     ✔ Work to the idea that shadows are produced by the blocking of the sun's light. When the sun's light is blocked by clouds there is no light for the trees and buildings to block.

- Can you feel any difference when the sun is blocked and when there is sunlight?
  ✔ Work toward a difference in temperature.

- How might you measure that difference?

2. **Continue the discussion about the image of the sun coming back on the screen.**

Ask such questions as these:

- How did the cloud look on the screen as the sun started to reappear?

- What happens to the light on the ground when the sun reappeared?

- When the sun reappeared did you see your own shadow? Why?
  ✔ Work toward the idea that the sunlight is no longer blocked and that bodies could again block the sunlight.

- Can you see the shadow of trees, buildings, and other objects when the sun is out? Why?

- Can you feel any difference when there is sunlight and when the sun is blocked?

- Can you feel a difference on the back and front of your hand when you hold it in front of your face to block the sun?

- What could cause these differences?
  ✔ Work toward the hypothesis that there seems to be a difference in temperature.

- How might you measure that difference?
  ✔ Work toward the idea of measuring the temperature.

- What questions do you have about clouds and sunlight?
  ✔ Have the students explore these questions while the cameras are still set up.

- Are there clouds behind the sun as well as in front of the sun? Why do you think so?

3. Have the students continue their inquiry about clouds and sunlight.

Have them
- State or restate their hypotheses about temperature and shadows or other ideas.
- Invent experiments to test their hypotheses.
  ✓ Work for experiments that simultaneously measure the temperature in shadow and sunlight.
- Test their hypotheses.
- Interpret results.
- Make generalizations.

EXTENSION

- Have the students hypothesize what happens to temperature in cloud shadows of long and short duration. Is there a difference between temperature after the cloud has been overhead for 2 minutes, 4 minutes, 6 minutes, and so forth? Experiment to find out.

2.8.4 COMPARING TEMPERATURES

OBJECTIVES

The students
- Measure the daily temperature, morning, noon, and afternoon.
- Graph the daily temperatures.
- Determine the average temperature on the first 4 sunny and first 4 cloudy days of each season.
- Make generalizations about relative temperature for morning, noon, and afternoon.
- Make generalizations about temperature and seasons.

BACKGROUND

This activity should be started along with or shortly after Activity 2.2.1 TEMPERATURE so the data is recorded on the Learning Calendar. In COMPARING TEMPERATURE there are two studies. The first compares morning, noon, and afternoon temperatures during the fall, winter, and spring. The second compares the temperature on sunny and cloudy days during the first part of fall, winter, and spring.

Graphing Daily Temperatures.

Each day that morning, noon, and afternoon temperature data is collected the students put the data on a class graph. Any days without data are left blank.

Average Temperature

The students get the average temperature for the first 4 sunny and first 4 cloudy days of each season. Average temperature can be described as a temperature that is about the same as the one we would expect to find most of the time in a particular place during a particular time of year. This average can be approximated by looking at a graph and estimating the average temperature by inspection. The average can also be gotten by taking the total of the temperatures for the fall sunny days, for example, and dividing by the number of days. This is repeated in winter and spring for cloudy and sunny days.

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Getting Average Data
DASH 2 students usually will be able to do addition. The sum of Celsius temperatures for 4 days will seldom exceed 150°C. It is suggested that Celsius temperature be used because a convenient number line can be made from two meter sticks that will include Celsius sums. The 4 day sum of Fahrenheit temperatures may run over 400°F.

Dividing by 4 to get an average can be done several ways. One method is to find the sum using a number line. Then measure the length of the interval between zero and the sum with a string. By folding the string in fourths and placing the 1/4 length back on the number line, 1/4 the sum, the *average*, can be read directly from the number line.

STUDENT ROLE

Meteorologist

MATERIALS

Learning Calendar
1-cm graph paper
Celsius thermometers
meter sticks or a number line
string
colored pencils or markers
class graphs from Activity 2.2.3 SUNRISE, SUNSET, AND SEASONS
Student Page 2.8.4 COMPARING TEMPERATURES

PRODUCTS

Temperature data
Class line graph of morning, noon and afternoon temperature
Class bar graph of the first 4 sunny and first 4 cloudy days of each season
Completed Student Pages

PROCEDURES

1. **After the students have been recording the temperature for several weeks on the Learning Calendar, introduce the need for some comparative temperature data.**

Ask such questions as these:

- For the fall how do you predict that temperatures at noon will compare with temperatures in the morning? With the afternoon temperatures at the end of the school day?
  ✔ Use Student Page 2.8.4 and circle which they predict will have the highest temperature, A.M., noon, or P.M.
  ✔ Use another mark such as an *L* for the lowest temperature prediction, A.M., noon, or P.M.

- How do you predict that temperatures taken at noon in the fall will compare with temperatures taken at noon in the winter? Spring? Summer?
  ✔ Have the students number the Season column on Student Page 2.8.4. Use a *1* for the season with the lowest average noon temperature, continuing on to a *4* for the season with the highest average noon temperature.

- What do you predict the highest temperature will be during the fall? The lowest fall temperature? The average fall noon temperature?
  ✔ Use Student Page 2.8.4 and under the *Predicted Temperatures* column have the students write their predictions *high*, *low*, and *average* temperature for the fall.

- How do you think the temperature at noon on a sunny day in the fall will compare with temperature at noon on a cloudy day in the fall? At noon on a sunny day in winter and at noon on a cloudy day in winter? At noon on a sunny day in spring and at noon on a cloudy day in spring?
  ✔ Use Student Page 2.8.4 to record predictions.

2. **Have the students decide how to set up a comparative study of temperature at three different times each day. Help them organize the data collection for the Learning Calendar and begin a class graph to compare temperatures.**

Help them

- Set up a collection schedule with times for collection.
  ✔ Add these jobs to the Responsibility Chart.

- Make a large class line graph with the temperature read vertically and the date horizontally.
  ✓ Use centimeter grid paper to keep the graph within the bounds of normal bulletin boards. A single season's graph will be about a meter long and no more than half meter high if Celsius readings are used.
  ✓ To keep up interest fill in the graph daily and refer to it regularly. Add the job of graphing to the Responsibility Chart.

- Use different colors to connect the morning, noon, and afternoon points from day to day on the graph.
  ✓ Leave any missed days, week ends, and vacations blank.

- Mark the first day of each new season with a vertical line. Label the line.

3. **At the end of each season have the students compare the average noon temperature of the first 4 cloudy days with the average noon temperature of the first 4 sunny days of that season. All data will be found on the Learning Calendar and the class temperature graph. Record on Student Page 2.8.4.**

Help them

- Get an average by mathematically adding the Celsius temperatures of the first 4 *sunny* days in the new season.
  ✓ If a temperature is negative subtract it.
  ✓ If the temperatures are mostly negative (below zero) establish a zero point and continue to subtract. This is the same process as *adding* but on the negative side of the zero, going the opposite direction on the number line.

- Find the total of the 4 Celsius temperatures on the number line.
  ✓ Two meter sticks put end for end will give a number line of 200 units.

- Measure the length from zero to the sum with a piece of string.
  ✓ This sum may be positive or negative.
  ✓ The string on the meter string can be used.

- Fold the string in fourths and lay it on the number line.
  ✓ The number at 1/4 the length will be the average temperature for the four days.

- Do the same for the first 4 *cloudy* days of the season.
  ✔ The students can record the average temperature of the first 4 cloudy days and the first 4 snowy days on Student Page 2.8.4.
  ✔ The students may further want to compare data from the four days following the middle of the season.

- Make a bar graph showing the average temperature for the first 4 sunny and first 4 cloudy days at the beginning of each season.
  ✔ Graph temperature on the vertical axis, and seasonal dates on the horizontal. Save the graphs for later discussion.

- Answer the question how did your prediction about the temperature of sunny and cloudy days turn out?

4. **At the beginning of winter, have the students analyze the morning, noon, and afternoon temperatures of fall.**

Ask such questions as these:

- What were your predictions about temperatures in the morning, at noon, and at the end of the school day?

- Were your predictions correct?

- Why do you think so?
  ✔ Have the students look to see about what range most of the temperatures fall into. This is the eye-ball equivalent to finding a mathematical average and one they can easily learn to use.

- How did your prediction about the temperature of sunny and cloudy days in fall turn out?
  ✔ Make a bar graph showing the average temperature for the first 4 sunny and first 4 cloudy days at the beginning of fall. See Procedure 3.

- What was the highest fall temperature? Lowest? Average noon temperature?

- Were your predictions correct? Why do you think so?

- How do the temperatures at the beginning of fall compare with the temperatures in the middle of fall? At the end of fall?

- What do you predict will happen to the temperatures during the winter. Record predictions on Student Page 2.8.4.

5. **At the beginning of spring, and the end of the school year have the students again analyze the morning, noon, and afternoon temperatures data.**

   Ask such questions as these:
   - What were your predictions about temperatures in the morning, at noon, and at the end of the school day?
   - Were your predictions correct? Why do you think so?
   - How did your prediction about the temperature of sunny and cloudy days in winter turn out? Spring?
     ✔ Make a bar graph showing the average temperature for the first 4 sunny and first 4 cloudy days at the beginning of each season. See Procedure 3.
   - What were your predictions about high, low, and average noon temperatures in the winter? Spring?
   - Were your predictions correct? Why do you think so?
   - How do the temperatures at the beginning of the season compare with the temperatures in the middle of last season? At the end of last season?
   - What do you predict will happen to the temperatures during the next season. Use Student Page 2.8.4.

6. **At the end of school, have the students correlate seasonal data.**

   Ask such questions as these:
   - How did the amount of clouds affect temperature? Why might this be?
   - How does the time of day affect temperature? Why might this be?
   - How does temperature relate to seasons?

EXTENSION

- Have the students compare their data with that from previous years.
  ✔ Keep data summaries from year to year.
  ✔ Have the students look for similarities and difference in the data.

2.8.5 ECLIPSES

OBJECTIVES

The students
- Observe solar and lunar eclipses that occur in their region.
- Note the point in the cycle of the moon when the event occurs.
- Use newspapers for information about eclipses.

BACKGROUND

This activity follows Activity 2.8.1 CAMERA OBSCURA and is one of opportunity. For an eclipse to occur, the moon and the sun must be in direct alignment with the earth. This happens from two to seven times in any year. However, only a few of these eclipses are going to be visible in any particular locality. Thus a student may have to go through several years of schooling before seeing either a solar or a lunar eclipse. Information about eclipses will be available in the DASH news of the CRDG *Science Education*, the NSTA Journal, *Science and Children*, and the local newspaper.

Importance of Eclipses

Eclipses are important in developing and validating parts of the DASH astronomy sequence and should be observed whenever possible. There are several ideas to be investigated. In eclipses the shadows of the earth and moon are both round. In both solar and lunar eclipses the moon is seen to be non-luminous or to generate no light of its own. The moon is observed to be nearer to the earth than the sun. Eclipses occur only at full and new moons.

Cautions

Observing a solar eclipse can be injurious to the eyes. Students should not look directly at the sun, particularly for any extended period of time. The sun's light can permanently damage the retina, in extreme cases producing blindness. However, the sun can be observed using a camera obscura. See Activity 2.8.1 CAMERA OBSCURA. Special viewing glasses can also be used. The camera is recommended because it allows students to draw a tracing of the sequence of the eclipse.

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STUDENT ROLE

Astronomer

MATERIALS

camera obscura from Activity 2.8.1 CAMERA OBSCURA
chart paper
markers
hardboard drawing surface
masking tape
field or opera glasses (optional for observing lunar eclipses)
Student Page 2.8.5 ECLIPSES

PRODUCTS

Class chart about eclipses
Completed Student Pages

PROCEDURES

1. **Introduce the activity with the announcement that there is about to be an eclipse.**

   Ask such questions as these:
   - Does anyone know what an eclipse is?
     ✔ Don't ask for explanation but accept any offered.
   - When do you think you would see an eclipse of the moon—at night or in the daytime?
   - When do you think you would see an eclipse of the sun—at night or in the daytime?

2. **If there is to be a lunar eclipse, have the students practice using opera or field glasses to observe the moon during the day.**

   Have them
   - Practice bracing their arms so that they can hold the moon in their field of view if opera or field glasses are to be used
   - Practice drawing the moon.
   - Predict where the eclipse of moon will be seen in the sky.

3. **Have the students watch the eclipse and report their observations using Student Page 2.8.5 ECLIPSES.**

Have them
- Observe and record the time of starting and ending.
- Make pictures of the various stages of the eclipse.
- Record the time of each stage or observation.
- Record the phase of the moon for the date of the eclipse.
- Save this Student Page in their Science Record Book for reference in DASH 4 and 5.

4. **After a lunar eclipse discuss the students' observations.**

Ask such questions as these:
- When did the eclipse begin?
- When did the eclipse end?
- How long did it take?

5. **If there is to be a solar eclipse, have the students practice using their camera obscuras to observe the sun.**

Have them
- Build their camera obscuras, if they are not already built. See Activity 2.8.1 CAMERA OBSCURA.
  ✔ Add the optional hand hole on the side of the box so they can trace what they observe on the screen.
  ✔ The size of the light hole may need to be reduced to a *pinhole* to get a clearly focused image. Cut a small square in the box where the light hole is to be. Cover it with aluminum foil. Use a pushpin or needle to make the hole in the foil. It will take the eyes somewhat longer to adjust in the reduced light.
- Practice getting their cameras in alignment with the sun.
- Practice drawing the sun through the hand hole in their camera.
- Predict where the eclipse of sun will be seen in the sky.

6. **After the eclipse discuss and review the students' observations.**

Ask such questions as these:

- When did the eclipse begin?
- When did the eclipse end?
- How long did it take?
- What was the shape of the of the sun as the moon passed over it?
  ✔ Get at the idea that the sun became crescent shaped. If the eclipse is total, the sun was blocked out with a possible light rim around it.
- Which is further away, the sun or the moon? What is your reasoning?
  ✔ Get at the idea that the moon was seen to pass in front of the sun. The sun peeked out from behind the moon like the sun peeks out from behind a cloud. The sun must be behind the moon and therefore, farther away.
- Does the moon make its own light? What is your reasoning?
  ✔ Get at the idea that the moon is seen to be dark like a shadow when it passes in front of the sun and it has no light.
- Which is bigger, the sun or the moon? What is your reasoning?
  ✔ Get at the idea that the sun is seen around the edges of the moon when the moon passes in front of it. Therefore, the sun which is farther away than the moon must be bigger than the moon.

EXTENSIONS

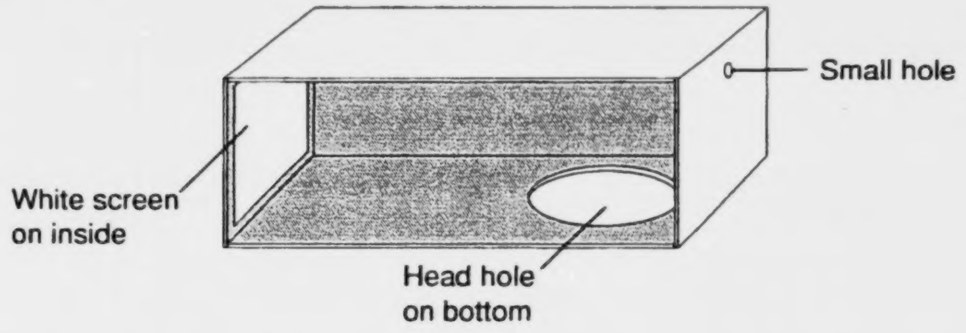
- Have an eclipse party and invite parents to bring the family to observe the eclipse.
- If there is lunar eclipse invite a local astronomy club to bring their telescopes to the party.

DASH

CAMERA OBSCURA SP 2.8.1

Name: ____________________

Date: ____________________


Small hole
White screen on inside
Head hole on bottom

1. Tape screen to one end inside the box.
2. Label the end with the screen on the outside of the box.
3. Seal the box completely with black paper and tape.
4. Draw an oval for the head hole.
5. Cut a hole in the box for your head. Try it.
6. Tape down any loose flaps inside the box.
7. Make the light hole with a fat nail.
8. Tape the bottom of a black t-shirt around the head hole.
9. Check for any light leaks. Retape them.

DASH

MIRRORS AND SUNLIGHT
SP 2.8.2

Name: ____________________

Date: ____________________

Draw the sun ☼ , yourself, and anyone else who helped you 🯅🯅🯅 , the mirrors you used ☐ ☐ , the target ◎ , and the path the light traveled - - - - - ► to show how you made the light hit each target.

TARGET A	TARGET B	TARGET C

TARGET D	TARGET E

How did you change the direction of sunlight using mirrors?

Does sunlight travel in straight of curved lines? Why do you say that?

DASH

CLOUDS AND SUNLIGHT
SP 2.8.3

Name: ____________________

Date: ____________________

How do you think shadows affect temperature?

Draw pictures or tell how you could test your idea.

Draw pictures or tell what happened.

How do you think shadows affect temperatures now?

DASH

COMPARING TEMPERATURES
SP 2.8.4

Name: ______________________

Date: ______________________

Predict when you think the temperature is highest and lowest.

Fall: AM Noon PM	Winter: AM Noon PM	Spring: AM Noon PM	Summer: AM Noon PM

Circle the kind of day you predict will have a higher temperature at noon for each season.

Fall Day: Sunny Cloudy	Winter Day: Sunny Cloudy	Spring Day: Sunny Cloudy	Summer Day: Sunny Cloudy

SEASON	DATE	TEMPERATURES		PREDICTED TEMPERATURES			ACTUAL TEMPERATURES		
		SUNNY AT NOON	CLOUDY AT NOON	HIGH	AVG	LOW	HIGH	AVG	LOW
FALL									
	AVG								
WINTER									
	AVG								
SPRING									
	AVG								
SUMMER									
	AVG								

DASH

ECLIPSES
SP 2.8.5

Name: ______________________

Date: ______________________

DATE OF ECLIPSE:	KIND OF ECLIPSE:
MOON PHASE:	TIME ECLIPSE STARTED:
	TIME ECLIPSE ENDED:

TIME	OBSERVATIONS

DASH

GRADE 2
CLUSTER 9

Conservation, Recycling, and Decomposition

2.9.1 Fall Unearthing

2.9.2 Fall Burying

2.9.3 Spring Unearthing

2.9.4 Spring Burying

2.9.5 Pollution Survey and Cleanup

2.9.6 Aluminum Recycling

2.9.7 Connections

GRADE 2
ACTIVITY GOALS

CLUSTER 9
Conservation, Recycling, and Decomposition

2.9.1 Fall Unearthing

To unearth and inspect materials buried in DASH 1 for the degree of decomposition; to develop a working definition of decomposition; and to develop observation and reasoning skills.

2.9.2 Fall Burying

To rebury materials previously unearthed to continue investigating their long term decomposition; to attempt to protect iron and wood from decomposition when they are buried; to introduce the concept of experimental control; and to develop observation, problem solving, and reasoning skills.

2.9.3 Spring Unearthing

To unearth and inspect materials buried in the fall of DASH 2 and inspect them for the degree of decomposition; to refine the working definition of decomposition; and to develop observation and reasoning skills.

2.9.4 Spring Burying

To rebury materials previously unearthed to continue investigating long term decomposition; to investigate new and revised methods of preseving wood and iron; and to develop observation, problem solving, and reasoning skills.

2.9.5 Pollution Survey and Cleanup

To become aware of the technological problem of solid-waste pollution; to make a survey of solid-waste pollution; to organize a solid waste clean up; to classify and quantify the collected waste; to develop a working definition of pollution; and to develop observation, planning, organizing, measuring, and reasoning skills.

2.9.6 Aluminum Recycling

To become aware of the need for and economic value of recycling resources; to recycle aluminum cans as an example of a recyclable resource; to involve DASH 5 students as intergenerational partners; and to develop observation, planning, organizing, interpersonal, and reasoning skills.

2.9.7 Connections

To develop a concept map of the connections between conservation, recycling, decomposition, pollution and to develop reasoning skills.

2.9.1 FALL UNEARTHING

OBJECTIVES

The students
- Unearth materials buried at the end of DASH 1.
- Investigate the degree of decomposition.
- Create a working definition of decomposition.

BACKGROUND

This activity is followed or done concurrently with Activity 2.9.2 FALL BURYING. The students may have attempted to preserve materials in DASH 1. If so get a sense of what did and did not work. The systematic study of protection of buried materials is begun here.

When possible unearth materials fairly early in the fall so that they will have more time in the ground before the spring unearthing. If there was no DASH 1 burial go directly to Activity 2.9.2 FALL BURYING.

In FALL UNEARTHING the students expand their understanding of decomposition by constructing a concept map and examining the materials buried in DASH 1. Making the concept map should be a very open-ended activity without restraints on the connections. The concept map should be posted and added to as the students' understanding grows.

STUDENT ROLES

Archaeologist
Agronomist

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MATERIALS

list of items buried in DASH 1
shovels
gloves
magnifying glasses
small sticks for moving decomposed materials
chart paper
markers
Working Dictionary
Student Page 2.9.1 FALL UNEARTHING

PRODUCTS

Working definition of decomposition
Concept map about decomposition
Completed Student Pages

PROCEDURES

1. **Develop and discuss a concept map about decomposition.**

   Help the students include such things as these:
   - Rusting.
   - Insect eaten.
   - Broken down.
   - Composting.
   - Smelly.
   - Return to the soil.

2. **Have the students dig up and inventory materials buried in the spring of DASH 1. Use gloves to handle buried materials.**

   Have them
   - Check the burial list from DASH 1 against the materials found.
   - Describe the decomposition.

3. **Summarize decomposition study to date by having the students complete Student Page 2.9.1 FALL UNEARTHING.**

   Ask such questions as these:
   - What kinds of items decompose quickly when buried?
   - What kinds of items decompose slowly?
   - Was any attempt made in DASH 1 to prevent decomposition of buried items successful? Which one or ones?

4. **Using their concept map have the students create a working definition of decomposition and record it in the Working Dictionary. Revise the concept map and Working Definition in the spring.**

EXTENSION

- Have the students compare their buried materials with those of others classes. Seek answers to the question, *Is decomposition generally the same for similar things?*

2.9.2 FALL BURYING

OBJECTIVES

The students
- Invent ways of protecting wood and iron.
- Are introduced to the idea of a control.
- Inventory and describe the materials to be buried.
- Bury the materials.

BACKGROUND

In this activity the students prepare to continue to observe decomposition of materials buried since DASH K. They also invent ways to prevent wood and iron from decomposing without using plastic. They may try using paint, foil, wax, oil, or non-plastic containers. The variations should be left as open ended as possible.

The idea of an experimental control is introduced in this activity. In this activity the control is the unprotected material (iron and wood) that is later compared with the protected material. A control gives the researcher an idea of how well a protection technique has worked.

STUDENT ROLES

Inventor
Agronomist

MATERIALS

shovels
plastic net bags or recycled nylon stockings
gloves
labeling tags in plastic bags
new wood blocks, popsicle sticks, or other wood pieces
new, ungalvanized (steel) nails
preserving materials as requested.
Student Page 2.9.2 PROTECTION

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PRODUCTS

Protected wood and iron items
Completed Student Pages

PROCEDURES

1. **Introduce the activity to the students by discussing ways to protect steel nails and wood from decomposition without putting them in plastic containers.**

   Include such ideas as
   - What seems to have produced decomposition in steel nails and wood since the original burying in DASH K.
   - Ask how wood fences and metal tools and lawn chairs are protected.
   - What methods, if any, worked to preserve things buried in DASH 1?
     ✔ DASH 1 students were to protect labeling tags with plastic.

2. **Help student groups invent ways to protect wood pieces and ungalvanized steel nails without using plastic containers (bags, boxes, and so forth.)**

   Help by
   - Providing materials requested.
   - Consulting on the labeling of the materials.
   - Discussing the idea of *control*.
     ✔ Get at the idea that to tell what has or has not happened to experimental materials scientists must have samples of the same materials that have not been experimented with. Here they need to have unprotected wood and steel nails.

3. **Have the students list all the materials to be buried and describe their wood and iron protecting methods on Student Page 2.9.2 PROTECTION.**

4. **Help the students bury the new materials and those from DASH 1.**

Have them

- Be sure to include an unprotected control nail and block of wood as well as protected iron and wood samples.
✓ Where possible keep any nails and wood already in the collection unprotected.

- Put the materials in plastic net-bags or recycled nylon stockings for easy recovery.
✓ Net bags put materials in contact with insects, moisture, and other possible decomposers in the soil.

- Mark and map the burial site.
✓ Keep the map in the Class Record Book and their Student Pages in their Science Record Books for use in the spring.

EXTENSIONS

Have the students

- Add other materials to the collection to be buried.

- Try various kinds of woods and nails (copper, aluminum, galvanized).

2.9.3 SPRING UNEARTHING

OBJECTIVES

The students
- Review the concept map about decomposition.
- Unearth buried materials.
- Inventory materials that decomposed and those that did not.
- Summarize their decomposition study to date.
- Revise working definition of decomposition.

BACKGROUND

In this activity the students return to the concept of decomposition. They observe the results of the decomposition of the materials they buried in the fall and then review their fall concept map. Using their observations, the students modify and refine their working definition of decomposition.

STUDENT ROLES

Archaeologist
Agronomist

MATERIALS

shovels
gloves
magnifying glasses
small sticks to move decomposed material
concept map about decomposition from fall
Working Dictionary
Student Pages 2.9.2 PROTECTION from fall burial
Student Page 2.9.3 PROTECTION INSPECTION

PRODUCTS

Completed Student Pages

BEST COPY AVAILABLE

PROCEDURES

1. **Have students dig up and inventory materials buried in the fall.**

   Have them
   - Check the materials found against the burial list from the fall.
   - Describe the decomposition of unprotected items.
   - Describe the decomposition of pieces of wood and nails that were protected and not protected from decomposition.

2. **Review the fall concept map about decomposition and revise as needed.**

3. **Summarize their decomposition study to date by having students complete Student Page 2.9.3 PROTECTION INSPECTION.**

   Ask such questions as these:
   - Are there some materials that have not decomposed at all?
   - What metals seem to decompose the fastest?
   - What seems the best way to preserve materials from decomposition?
   - Can you think of other ways to protect materials from decomposition? What are they?

4. **Have students review and refine their working definition of decomposition and record the results in the Working Dictionary.**

2.9.4 SPRING BURYING

OBJECTIVES

The students
- Expand their concept of decomposition.
- Invent additional ways to preserve wood and iron.
- Bury materials to continue watching decomposition.

BACKGROUND

In this activity the students continue their study of the preservation of wood and steel in the form of nails. If not already included in their list of materials they add grass. The activity is completed at the beginning of DASH 3 where it serves as an introduction to composting.

STUDENT ROLE

Agronomist

MATERIALS

shovels
gloves
materials not yet decomposed since DASH K
new wood pieces and steel nails
plastic net-bags or recycled nylon stockings
tags in plastic bags
grass cuttings
preserving materials as requested.
Student Page 2.9.4 PRESERVATION

PRODUCTS

Completed Student Pages

BEST COPY AVAILABLE

PROCEDURES

1. **Establish objectives of reburial with the class by reviewing work to date on decomposition.**

   Discuss such things as these
   - Reburying the materials dug up from the fall burial to continue the observation of decomposition and attempts at preservation of wood and nails.

   - Ask student what they expect to occur if they add grass cuttings to the materials.

2. **Have student groups invent new ways to protect wood and nails from decomposition.**

   Have them
   - Request materials needed.

   - Label materials to be buried.

3. **Help the students inventory and describe the materials to be reburied using Student Page 2.9.4 PRESERVATION. Store information in their Science Record Books for DASH 3.**

4. **Have the students prepare the materials for burial.**

   Have them
   - Place the materials in plastic net-bags or recycled nylon stockings so that the materials come in contact with soil and water.

   - Be sure to include some unprotected grass cuttings.

5. **Have the students bury the materials and map and mark the site. Keep the record in the Class Record Book.**

EXTENSION

- Have the students add new materials of their own choosing to the burial collection.

2.9.5 POLLUTION SURVEY AND CLEANUP

OBJECTIVES

The students
- Develop a concept map about pollution.
- Organize and carry out a pollution survey and cleanup.
- Sort and weigh the amount of trash collected.
- Summarize their cleanup with a graph.
- Develop a working definition of pollution.

BACKGROUND

POLLUTION SURVEY AND CLEANUP precedes Activity 2.9.6 ALUMINUM RECYCLING and builds a base for Activity 2.9.7 CONNECTIONS.

In this activity the students first develop a concept map about pollution. Then they organize a survey and carry out a cleanup of solid waste of some part of the school campus or some other area. Finally they graph the amounts of different kinds of solid-waste that they find.

Sites

The survey and cleanup area may include the school ground areas where students are likely to litter. If the campus is clean, areas outside school may be used. If possible find a place where aluminum cans are discarded.

Caution

Any areas where there is traffic or other hazards such as barbed wire, discarded building materials, or garbage should be avoided. Adult supervision is very important in this activity. Be sure the students wear gloves.

STUDENT ROLES

Sanitary engineer
Ecologist

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MATERIALS

1-inch graph paper
gloves
garbage bags
chart paper
bathroom scales
pick-up stick for garbage
Working Dictionary
Student Page 2.9.5 POLLUTION SURVEY

PRODUCTS

Cleaner campus or other area
Working definition of pollution
Class graph of litter collected
Completed Student Pages

PROCEDURES

1. **Develop a concept map about pollution with the class.**

   Help the students include such things as
   - Air pollution.
   - Water pollution.
   - Solid waste pollution.
   - Ugly.
   - Insect and animal infestations.
   - Potential dangers.

2. **Introduce the problem of finding what kinds of solid waste are on and around the school campus and why they need to be removed.**

   Ask such questions as these:
   - What kinds of things make up solid waste?
   - Why is it important to get rid of solid waste?
   - How is solid waste usually gotten rid of?

3. **Take the students to observe the area to be cleaned and survey what should be picked up. Help them organize to clean up the area.**

   Have them consider
   - The boundaries of the survey.
   - Who is to pick up what.
   - What equipment they will need to pick up and carry back the solid waste.
     ✔ Get at such things as gloves, garbage bags, and so forth.
   - What safety and sanitation precautions need to be taken.
     ✔ Get at such things as handing sharp objects, wearing gloves, washing afterwards, and so forth.
   - How to sort and weigh the trash.
     ✔ Make arrangements with the campus grounds crew for a place to do this.
   - Job assignments.
   - How to arrange for parents or other adults to help if needed.

4. **Have the students carry out the cleanup. Stress safety and sanitation.**

5. **Help student groups sort and weigh the materials.**

   Have them
   - Sort and weigh or count the materials according to the type of solid waste.
     ✔ A bathroom scale will work well in the field.
   - Complete Student Page 2.9.5 POLLUTION SURVEY.
   - Make a graph showing the amounts and kinds of litter collected.
     ✔ Have the students make a bar graph of the weights of different types of trash—paper, Styrofoam, plastic, glass, aluminum, iron, and others.

6. **Help the students summarize their findings. Have them add to their concept map about pollution and create a working definition of the term *pollution*.**

Ask such questions as these:

- Which of the materials that you picked up will decompose quickly? How much of this kind of material did you pick up?
- Which of the materials will take a very long time to decompose? How much of the kind of material did you pick up?
- Are any of the materials dangerous? How?
- How could you help reduce the accumulation of solid waste?

EXTENSIONS

Have the students

- Make a bulletin board display for the school to show the kinds and amounts of solid waste recovered.
- Write an article for the school newsletter reporting the kinds and amounts of waste recovered and suggesting ways students can help reduce solid waste pollution.
- Map the areas where solid waste was found. Color-code the map to show the relative amounts and kinds of waste.
- Write letters to any fast food or other establishments whose solid waste is exceptionally abundant.
- Save their graphs for comparison in later years.
- Make posters with aphorisms encouraging students not to litter.

2.9.6 ALUMINUM RECYCLING

OBJECTIVES

The students
- Review their concept map about pollution.
- Plan, organize, and implement a cross-grade-level recycling project.
- Invent and test can crushers.
- Develop an understanding of the value of recycling.

BACKGROUND

Each year in DASH there is a cross-grade-level recycling project. It is suggested that in DASH 2 the students work with DASH 5 students to collect aluminum cans. ALUMINUM RECYCLING usually follows Activity 2.9.5 POLLUTION SURVEY AND CLEANUP where the need to recycle is observed and is followed by Activity 2.9.7 CONNECTIONS after this recycling experience.

In ALUMINUM RECYCLING the students develop or enlarge their concept map about pollution. They plan and implement a recycling project. Student groups invent and test can crushers. Ideally this is done as an cross-grade-level project with a DASH 5 class. Involvement with DASH 5 students will require coordination, led where possible by the students.

Alternative Recycling Projects

Any recyclable materials can be the focus of DASH 2. However, aluminum is singled out because of its light weight, the probable availability of aluminum cans around schools, and it is a common recyclable item in many communities. All recycling projects should be coordinated with the school administration. If other recyclables are to be collected, the activity plan outlined here can still be used.

Phone Skills

ALUMINUM RECYCLING gives the students an opportunity to practice telephone skills. They can use the phone book to identify recyclers, then phone for prices, hours of operation, and other necessary information. A speaker phone will enable the entire class to participate.

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STUDENT ROLE

Recycler

MATERIALS

garbage bags
scales
gloves
telephone (speaker phone if available)
telephone directory
materials for can crushers as requested
Student Page 2.9.6 RECYCLING ALUMINUM

PRODUCTS

Recycled aluminum
Possible monetary return for the class
Completed Student Pages

PROCEDURES

1. **Review with the class the concept map about pollution. See Activity 2.9.5 POLLUTION SURVEY.**

2. **Discuss the aluminum recycling activity with the students.**

   Ask such questions as these:
   - Which of the solid waste items that you found in your cleanup lasts the longest in the ground? How do you know?
     ✔ Work for metals including aluminum, glass, and plastics.
     ✔ Work for their studies of decomposition.

   - Which of these solid wastes can be used again?

   - What words are used to refer to using materials over again?
     ✔ Get at such terms as recycling, conservation, reusing.

   - Which of the solid wastes could you recycle for money ?
     ✔ Work to include, metals, especially aluminum, glass, paper, and plastics.

   - How could you find out how much money you could get for different kinds of waste?
     ✔ Get at looking up recyclers in the telephone directory.

- What other questions do you need to ask if you want to collect aluminum or other materials for recycling?

3. Have the students use Student Page 2.9.6 RECYCLING PROJECT to list questions to ask recyclers.

Help them list such questions as
- What kind of waste do you buy?
- How much is each kind of waste worth?
- How often does your price change?
- What condition must the waste be in?
- Do you pick up the waste or must the collector bring it to you?

4. Help the students set up a procedure for making the phone calls. Be sure they include who is to ask each question. Have the students make the phone calls and get the information needed. Record the responses on Student Page 2.9.6 RECYCLING PROJECT.

5. Help the students decide on and organize for a recycling project. This is the time to invite a DASH 5 class to assist in the project.

Ask such questions as these:
- Who needs to be contacted to get approval for the project?
- When will the waste items be collected?
- How will you keep track of how much you have collected?
- Who will contact the recycling company?
- Will you need any special help?
  ✔ Suggest that the DASH 5 students have indicated that they might help in the project.
- What help is needed?
  ✔ Get at such things consulting, lifting ,carrying, transporting to the recyclers, and so forth.
  ✔ Parent help may be needed to transport cans to the recyclers.

- How can you get help?
  ✔ Suggest that a letter inviting the DASH 5 class to join them would be appropriate.
  ✔ Organize to invite the DASH 5 class to join in the project.

6. **Have the students discuss storage space problems and possible solutions. Have the students invent a way to crush cans. This may be the time to invite DASH 5 consultants to help.**

   Help the students

   - Find space to store their cans.
     ✔ Alert the administration, and have the class send a delegation to the principal to discuss storage.
     ✔ Emphasize with students that solutions to environmental and engineering problems involve many people who have to make decisions. In this case decisions have to be made about using school space.

   - Discuss reasons for crushing cans to save space.

   - Invent ways of crushing cans.
     ✔ Inventions may range from stepping on them to hinged nutcracker-like systems.

   - By providing materials as requested.

   - Test the effectiveness of their various inventions.
     ✔ Have them demonstrate and explain their devices and techniques to crush cans to the class.

7. **Help the students invent a device for weighing cans. See Activity 2.10.3 THE BALANCE.**

   Help them

   - Discover their balance can only weigh a few cans at a time.

   - Invent a way to weigh one pound of cans.
     ✔ A one pound can of beans can be used as a counterweight.
     ✔ Boxes, bags, plastic containers can be used as pans.

   - Find out how many cans it takes to weigh a pound.
     ✔ Most recyclers use 25 soda cans as their unit equivalent for a pound.

   - Answer the question, *Do 25 aluminum cans always weigh about the same amount?*

- Answer the question, *If you know how many cans you have, and how much 25 cans weigh, is it possible find out/estimate how much all the cans weigh?*
  ✔ Again this may be a good time to bring in DASH 5 consultant.

8. **Help the students carry out the recycling project.**

9. **Help them plan and hold a recycling party or write letters to thank people who helped in the project.**

10. **Summarize the project.**

    Ask such questions as these:
    - Why does the recycler pay money for different kinds of solid waste?
    - How does recycling help keep the school community clean?
    - How does recycling help keep the larger community clean?

EXTENSION

- Make a cumulative recycling bar graph to show how much aluminum is collected each week.

2.9.7 CONNECTIONS

OBJECTIVES

The students
- Make a concept map of connections between the terms conservation, recycling, pollution, and decomposition.
- Revise their working definitions of conservation, recycling, pollution, and decomposition.

BACKGROUND

This summary activity should be done at the end of the school year after Activities 2.9.1-2.9.6. The students first make separate maps for the concepts recycling, conservation, pollution, and decomposition. They then show how these concepts are connected.

STUDENT ROLE

Lexicographer

MATERIALS

chart paper
markers
Working Dictionary
Connections Book
Student Page 2.9.7 CONNECTIONS

PRODUCTS

Concept maps
Working definitions
Completed Student Pages

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PROCEDURES

1. **Have the students create separate concept maps about conservation, recycling, pollution, and decomposition. Then fit them together creating a web showing the connections between the terms. Label the connections.**

Have the students

- Use Student Page 2.9.7 CONNECTIONS to first individually brainstorm ideas about conservation, recycling, pollution, and decomposition.

- Share what they remember about conservation.
  ✔ Get at such ideas as conservation or saving of electricity, paper, water, and so forth. Record their ideas on a class or group concept map about conservation.
  ✔ One or more groups can be asked to make each concept map.

- Share what they remember about recycling.
  ✔ Get at such ideas as using things over, making of paper out of used paper, recycling aluminum and glass, saving resources, and so forth. Record their ideas on a concept map.
  ✔ One or more groups can be asked to make each concept map.

- Share what they remember about pollution.
  ✔ Get at such ideas as breakdown of things, bad for health, build up of unsightly or dangerous things, water pollution, air pollution, and so forth. Record their ideas on a concept map.
  ✔ One or more groups can be asked to make each concept map.

- Share what they remember about decomposition.
  ✔ Get at such ideas as a natural breakdown of things, recycling of once living things back into soil, rusting, molding, and so forth. Record their ideas on a concept map.
  ✔ One or more groups can be asked to make each concept map.

- Assemble these four separate concept maps to make one large integrated map on a single sheet of paper or a bulletin board.
  ✔ Several such integrated maps can be made.

- On the integrated maps build a web showing connections between the concepts in the component maps.
  ✔ Label the connecting lines to describe the relationships between concepts.

- Transfer the connecting words to Student Page 2.9.7 CONNECTIONS.

- Add new ideas to the Connection Book.
  ✔ Ask the students questions about the importance of knowing about decomposition, pollution, recycling, and conservation; about *who* needs to know about these things; and about where information about these ideas can be used.

2. **Have students revise their working definitions of conservation, recycling, pollution, and decomposition. Record their revisions and additions in the Working Dictionary.**

SP 2.9.1

DASH

FALL UNEARTHING SP 2.9.1

Name: ____________________

Date: ____________________

DATE BURIED:	DATE UNEARTHED:

THINGS BURIED	FOUND?		OBSERVATIONS
	YES	NO	

DASH

PROTECTION
SP 2.9.2

Name: ______________________

Date: ______________________

DATE OF BURIAL:	BURIAL TEAM:
LOCATION OF BURIAL:	
PROTECTED	HOW PROTECTED?

LIST OF ALL THE OTHER THINGS BURIED

DASH

PROTECTION INSPECTION SP 2.9.3

Name: ______________________

Date: ______________________

DATE OF INSPECTION:	INSPECTION TEAM:

THINGS BURIED	OBSERVATIONS

DASH

PRESERVATION
SP 2.9.4

Name: ____________________

Date: ____________________

DATE OF BURIAL:	BURIAL TEAM:
LOCATION OF BURIAL:	
THINGS BURIED	DESCRIPTION

Describe how your team preserved the wood and nail.

DASH

POLLUTION SURVEY SP 2.9.5

Name: ______________________

Date: ______________________

KIND OF WASTE	QUANTITY	WEIGHT	OBSERVATIONS

DASH

RECYCLING PROJECT SP 2.9.6

Name: ____________________

Date: ____________________

RECYCLER:
PHONE NUMBER:

QUESTIONS TO ASK RECYCLERS	ANSWERS

DASH

CONNECTIONS
SP 2.9.7

Name: ____________________

Date: ____________________

CONSERVATION

RECYCLING

POLLUTION

DECOMPOSITION

DASH

GRADE 2
CLUSTER 10

Matter, Space and Construction

2.10.1 Desk Organization

2.10.2 Notebook Organization

2.10.3 The Balance

2.10.4 Meter-String Can

2.10.5 Measuring Volume

2.10.6 Safety Equipment

GRADE 2
ACTIVITY GOALS

CLUSTER 10
Matter, Space, and Construction

2.10.1 Desk Organization
To recognize the need for organization in the work place; to invent and construct a desk organizer; and to develop organization, spatial conceptualization, problem solving, construction, and reasoning skills.

2.10.2 Notebook Organization
To recognize the need for organizing information for retrieval; to invent and implement a way to quickly retrieve materials from a notebook; and to develop organization, problem solving, construction, and reasoning skills.

2.10.3 The Balance
To introduce the process of weighing; to build a balance; to introduce the gram as the standard unit of mass; to explore to find objects with masses about one gram; and to develop construction, measuring, and reasoning skills.

2.10.4 Meter-String Can
To make a linear distance measuring tool; to use the tool to determine a personal pace; and to develop construction, measuring, and reasoning skills.

2.10.5 Measuring Volume
To make a volume measuring tool; to use the tool in determining the volume of various containers; and to develop construction, measuring, and reasoning skills.

2.10.6 Safety Equipment
To make safety a focus of class concern by establishing a safety team; to construct safety equipment including aprons, raincoats, hand protectors, and face shields; to identify tool safety as a major concern; and to develop construction, measuring, and reasoning skills.

2.10.1 DESK ORGANIZATION

OBJECTIVES

The students
- Recognize the need for organizing the contents of their desks.
- Invent a device to organize the contents of their desks for quick, easy access.
- Construct, use, and modify organizing devices as needed.
- Make generalizations about organization in storing and packing objects.

BACKGROUND

This activity is a companion to 2.10.2 NOTEBOOK ORGANIZATION. It continues the themes of space, organization, and packing begun in DASH K. It is designed around the perennial need to turn personal storage areas into spaces that not only hold materials but also give quick access to them.

Central to this activity is the virtue of neatness. This activity is best done when there is an apparent need for organization of personal storage spaces.

Organizers

Since personal storage areas differ from school to school and often from class to class, the problem of satisfactory storage can be solved in a variety of ways. For example, a push-in-pull-out tray may be used for under-desk storage or a divided tray for in-desk storage. The design is to be the student's own invention. Materials are limited only by availability.

STUDENT ROLES

Inventor
Packager

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MATERIALS

cardboard box bottoms that held 24 soda cans
recycled cardboard
assorted recycled containers
scissors
universal scissors or serrated steak knives to cut cardboard
masking tape
stapler
Student Page 2.10.1 MY DESK ORGANIZER

PRODUCTS

Space organizer
Completed Student Pages

PROCEDURES

1. **Play a *How Quickly Can You Get It?* game.**

   Instructions
   - Ask the students to see how fast they can get certain items out of their desks. Only the items named are to be taken out.
   - Name several items and time the students to see how long they take to get all the items on top of their desks.
   - Have the students put these items away and repeat the game with these and other items.

2. **Have the students identify a need for organizing their personal storage area by discussing the game.**

   Ask such questions as these:
   - Who was fastest in the first game?
   - How were you able to get your materials quickly?
   - Who was fastest in the second game?
   - How were you able to get your materials quickly?
   - What can you do to get materials out of your desks more quickly?

✔ Work toward the idea of organizing the space.

- Is there something you can invent and build to help better organize your space?

3. **Have the students invent and build a storage-space organizer.**

    - Have them make a drawing of their organizer on Student Page 2.10.1 MY DESK ORGANIZER.

    - Have them organize storage space using their organizer.

4. **Play *How Quickly Can You Get It?* again and discuss the results.**

    Ask such questions as these:
    - Did your space organizer help improve your time in getting items?

    - How did your space organizer help you?

    - Are there advantages to having a messy desk?
      ✔ Can store things faster.

    - What disadvantages are there to having a messy desk?
      ✔ Can't find things quickly.

5. **Have the students make generalizations about the importance of organized storage.**

    Have them
    - Find examples of well-organized storage.

    - Observe and report on the consequences of well-organized storage.

    - Find examples of poorly organized storage.

    - Observe and report on the consequences of poorly organized storage.

6. **Have the students use their understanding of the need for organization and their construction skills to help organize the classroom. Have them organize such things as classroom supplies, class hand tools, and other materials as needed.**

EXTENSIONS

- Have the students develop aphorisms about organization and neatness.
- Encourage students to improve their space organizer as needed.
- Play *How Quickly Can You Get It?* periodically to refocus on the need for organizing things around us.

2.10.2 NOTEBOOK ORGANIZATION

OBJECTIVES

The students
- Invent ways to organize their Science Record Books for quick and easy access.
- Make generalizations about organization when storing and retrieving information.

BACKGROUND

This activity continues the theme of organization and is a companion to Activity 2.10.1 DESK ORGANIZATION. It is designed around the enduring problems of recording and retrieving information. This activity is best introduced at the beginning of the year when Science Record Books are first started.

Kinds of Notebooks.

Notebooks may be commercial ring binders, but this may diminish some of the creativity in making and decorating one's own Science Record Book. Manila folders or cardboard with paper held by some sort of fastener are good alternatives.

Effective Retrieval

Effective information retrieval is essential to our technological society and continually touches students' lives. The emphasis here is on personal organization of information for communication purposes. Procedure 5 will help the students to become aware of how information in books is organized for quicker and more complete access.

Ways of Organizing

There are many ways recorded materials can be organized to give easy access to information. The students should understand that organization for retrieval is both useful and aesthetic. Organizational methods must satisfy the students, their peers, and their teacher. Since aesthetic organization of information comes less naturally, it is suggested that functionality or usefulness be the first criterion of organization.

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At the basic level there needs to be a way of
- Keeping records from getting lost.
- Preserving the contents of records. This includes, securing pages to reduce the chance of tearing and fraying, covering papers to protect them from smudging, smearing, water destruction, and so forth.

At levels of increasing sophistication, organization may take the form of
- Ordering records by subject matter area.
- Ordering records by date of production, topic, or kind of product.
- Ordering items alphabetically.
- Dividing records into sections.
- Making tables of contents.

STUDENT ROLES

Writer
Scientist
Technologist
File clerk
Secretary
Record keeper

MATERIALS

markers
paper punch
stapler
brads
scissors
paper clips
cardboard
file folders
notebooks
materials as needed
Student Page 2.10.2 NOTEBOOK ORGANIZER

PRODUCTS

Organized Science Record Books
Completed Student Pages

PROCEDURES

1. **As new records and sets of papers are produced, help the students to see why information needs to be kept for later reference.**

   Ask such questions as these:
   - Why do you want to keep a record of what you have done?
     ✔ Get at the idea that you keep records to help remember what you have done and to share ideas with others. Mention that scientists and technologists keep records of their work.

   - Do you want to keep this paper or set of papers?
     ✔ Lead students through an analysis of whether a particular record or piece of paper helps them remember what they have done or lets them share their ideas with others.

2. **As new kinds of papers are produced, help the students to agree upon a format for organizing them. Record the format on Student Page 2.10.2 NOTEBOOK ORGANIZER.**

   Ask such questions as these:
   - Where in your Science Record Book should you keep this kind of record?

   - Should you make a separate Science Record Book for each kind of record?

   - How could you organize this kind of record—by date, by topic, alphabetically, other ways?
     ✔ This question and those that follow are probably best asked as more of the same kind of records accumulate.

   - Should pages be numbered?

   - Should you have a table of contents?

   - Should everyone's Science Record Books be the same? Why?

3. **Have the students design and make their Science Record Books.**

4. **To emphasize the importance of organizing records, play the *How Quickly Can You Find It?* game.**

   Instructions
   - Introduce the idea of seeing how fast the students can find certain papers in their Science Record Books.
   - Name some particular worksheet or other record and have the students see how fast they can find it.
   - Have different students report on how they were able to find the paper.
   - Have the students discuss how organization of their Science Record Book helped or hindered finding the papers.

5. **Have the students compare their Science Record Book with a textbook.**

   Ask such questions as these:
   - What are the parts of a textbook?
   - How is the textbook like your Science Record Book? How is it different?
   - How is a dictionary organized? How is it like your Science Record Book?
   - How is the dictionary like your Working Dictionary? How is it different?

EXTENSIONS

- Have the students report on the organization of newspapers, magazines, almanacs, and so forth.
- Have the students report on the electronic organization of information such as that found for computer disks and on the internet.

2.10.3 THE BALANCE

OBJECTIVES

The students
- Explore the concept of weighing.
- Build their own balances and use them.
- Are introduced to the concepts of mass and the metric unit of mass, the gram.

BACKGROUND

This activity is introduced when a balance is needed to weigh things. See Activities 2.4.1 SOIL and 2.9.6 ALUMINUM RECYCLING.

The Balance

In THE BALANCE students start to investigate weighing by building and using balances. They first invent their own balance and counterweights using pennies, paper clips, beads, and so forth to weigh an aluminum can. The problem of reporting in different units when weighing the same object is discovered and discussed.

Mass

Through a structured inquiry, *mass* is introduced as a measure of the amount of stuff or *matter* in things. We measure mass on a balance. Then the gram is presented as the standard unit of mass. Finally, the students determine the mass of an aluminum can in grams.

STUDENT ROLE

Engineer

MATERIALS

chart paper
heavy-duty paper clamps
paper clips, large
rulers
matched pairs of wide mouth containers

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nail or ice pick
string
small, nearly identical objects for counterweights, such as small paper clips, beads, pennies, marbles, nickels, nails,
clean identical aluminum cans, 1 per group
centigram cubes, cube-a-grams, or other metric weights
masking tape
Working Dictionary
Student Page 2.10.3 COUNTERBALANCES

PRODUCTS

Balance
Class chart about weighing
Working definitions for mass and gram
Completed Student Pages

PROCEDURES

1. **Have the students make a concept map of the term *weighing*. Include weighing devices (scales, balances) and units (grams, pounds, and so forth).**

2. **Discuss the need for a balance to weigh cans, soil, and other things. Discuss how to make a balance. If the students have no experience with balances draw one or show them a picture. See Figure 2.10.3.**

   Ask such questions as these:
   - What parts does a balance have?
     ✔ Include the pans, the beam or bar holding the pans, the pan holders, and the pivot.

   - What could you use for parts to make a balance?
     ✔ Include items needed in an Inventors Box.

3. **Have the students work in pairs to invent, build, and test balances.**

   Ask such questions as these:
   - Does your balance swing easily or move up and down easily?
     ✔ If not help them investigate the pivot.

- How can you tell when two different objects weigh the same?
  ✔ Work for such things as the pans seem to be even, the bar or beam is not tipped, and so forth.

- What could you use as counterweights to weigh things?
  ✔ Have them select form such things as nails, paper clips, pennies, washers, and so forth to use as counter balances.

4. **Introduce the idea that when you use a balance you are measuring the amount of stuff or matter in the thing. Carry out a demonstration while the students work in pairs.**

- Have one student close their eyes and hold out their hand and say, *Now.* At any time thereafter their partner puts a thing such as a pencil, penny, or nail in their hand. The instant the student senses the object they raise their other hand.

- Without explanation, have student reverse roles and repeat.

- Ask, *How did you know when your partner put the thing in your hand?*
  ✔ Get at such things as felt a push on the hand, could feel its shape, sensed it, and so forth.

- Ask, *Does the balance in some way* ***feel*** *or respond to the things that are put in its pans?*
  ✔ Have them put some things on the balance and see.

- Ask, *What did the balance do?*
  ✔ Get at the observation that the balance arm or pan went down.
  ✔ Explain that what the balance responded to is called *mass*, the *stuff* in the thing. A stuffy equivalent word is *matter.*
  ✔ When you use a balance you are measuring the mass of a thing or how much matter is in it.

5. **Have students work in pairs to weigh identical aluminum cans using their own selection of counterweights.**

Help
- All groups weigh the same type of aluminum can.

- Each group record data on a class chart,

- The students discuss why the results of weighing seem to vary between groups.
  ✔ Get at the idea that different groups are using different counterweights.
  ✔ Work to the idea that to talk about how much something weighs you need to use standards or counterweights which are the same.

6. **Give the students a nickel and tell them that it has a mass of 5 grams and that we measure mass in *grams*. Help them explore to find answers to a set of challenge questions.**

Ask such challenge questions as these:

- How many small paper clips have about the same mass as the 5 gram nickel? How many centigram cubes or cube-a-gram counterweights have the same mass as a nickel?

- How many paper clips have a mass of about a one gram ? How many centigram cubes or cube-a-grams?
  ✔ Centigram cubes and cube-a-grams have masses of about 1 gram. Paper clips will vary.

- What is the mass of the aluminum can in grams?
  ✔ Help the students select counterweights that have masses of a gram such as centigram cubes or cube-a-grams and counterweights that are multiples of a gram such as nickels.

- Do you all get about the same answer?
  ✔ Have the students with about the same answers check the work of those with answers that are far off.
  ✔ The mass will be about 18 grams.

6. **Summarize the activity.**

Ask such questions as these:

- How does a balance work?

- How do you know when there is the same amount of mass on either side of the balance?

- How could you improve your balance?

- What is mass?
  ✔ Get at the idea that it is the *mass* of a thing that moves balance. Mass tells us how much stuff or matter is in a thing.
  ✔ Record a working definition for mass in the Working Dictionary.

- What is a gram?
  ✔ Get at the idea that you measure mass in *grams*. A nickel has a mass of 5 grams, a centigram cube has a mass of 1 gram, and so forth.
  ✔ Record a working definition of gram in the Working Dictionary.

EXTENSION

- Set up a weighing station or center and have the students report the masses of assorted objects. Have the listed masses available after they have finished their weighing.

ILLUSTRATION

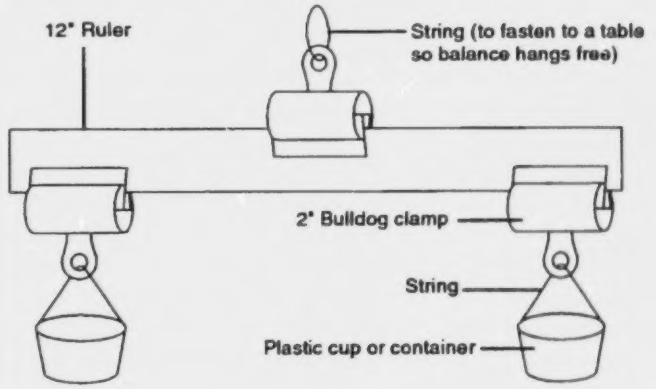
12" Ruler
String (to fasten to a table so balance hangs free)
2" Bulldog clamp
String
Plastic cup or container

Figure 2.10.3 Sample student balance.

2.10.4 METER–STRING CAN

OBJECTIVES

The students
- Make a meter-string can for measuring distance.
- Calibrate the measuring string in meters.
- Discuss the need for standard units of measurement.
- Use the meter-string can to measure distances.

BACKGROUND

This activity should precede Activities 2.7.3 RACING AND MODIFYING CARS and 2.7.5 BUILDING A VILLAGE. In METER-STRING CAN students make a 10 meter measuring string. This tool is used throughout DASH. See Figure 2.10.4. Make the meter-string can before the students need to measure distances of several meters.

The meter-string can is introduced in DASH 1. If the students have previously made meter-string cans, 6 new ones will satisfy measurement requirements. If they have not had DASH 1, have them work in pairs to make the devices.

STUDENT ROLE

Surveyor

MATERIALS

1 coffee can or other can with plastic lid per group
10 and 1/2 meters of heavy cord per group for each the meter-string
washers or large paper clips to secure string inside can
nails to make a hole in the can
hammers
masking or plastic tape
meter sticks
1 waterproof felt pen per group
Student Page 2.10.4 MEASURING LENGTH

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PRODUCTS

Standardized meter-string cans
Completed Student Pages

PROCEDURES

1. **Have student groups make meter-string cans. Show them a prototype.**

   Have them

   - Mark off a 10 meter scale on the classroom floor or in a hallway. Use masking tape to mark and label the meter points on the floor.

   - Cut a piece of the string 10 and 1/2 meters long. Tie a knot in one end of the string so that it will not unravel. This knot will be the zero point.

   - Pull the string so that it is straight but not stretched, laying it along the 10 meter scale so each meter can be marked with a marker.

   - Cover each meter mark with tape and label it with a waterproof pen.

   - Secure the string to the can by passing it through a hole on the side near the bottom. Tie the string to a washer or a large paper clip on the inside of the can.
     ✔ Have the students confront the problem of which end of the string should be attached to the can—the 0 meter end or the 10 meter end.
     ✔ Have both systems tested for convenience. Ask teams with strings attached differently to measure out 4 meters. Compare the results.
     ✔ Where necessary, have the students retie their strings to make their can more convenient.

   - Wind the string around the outside of the can for storage.
     ✔ The can may be used for equipment storage in the field.
     ✔ A rock can be put in the can to anchor it so a single person can make measurements.

2. **Help the students standardize their measuring strings by comparing them. Lay the strings side by side.**

   Ask such questions as these:
   - How long is your string compared to others?
   - Are the intervals between the meter marks the same?
     ✔ If not help the students measure again and retape as needed.
   - How many meters can you measure with your measuring string?
   - Does any tape need to be renumbered? Which one? Why?
     ✔ If so help the students renumber.
   - How could you get a half meter? A quarter meter?
     ✔ Introduce 1/2 meters and 1/4 meters by folding the string in halves and quarters.

3. **Have the students label the first meter of their string with tape at the 1/4, 1/2, and 3/4 meter points.**

4. **Have the students use Student Page 2.10.4 MEASURING LENGTH to practice measuring with their meter-string cans.**

5. **Set up a measuring center with challenges for continued practice.**

EXTENSION

- Provide students with a more concrete example of a fractional meter Use 3 meter sticks. Cut one into quarters and one into halves. These can be used to reinforce the ideas of 1/4, 2/4, 3/4, and 4/4 and 1/2 and 2/2. Equivalents of 2/4 m = 1/2 m; 4/4 m = 2/2 m = 1 m; and (1/2 m + 1/4 m) = 3/4 m will emerge.

ILLUSTRATION

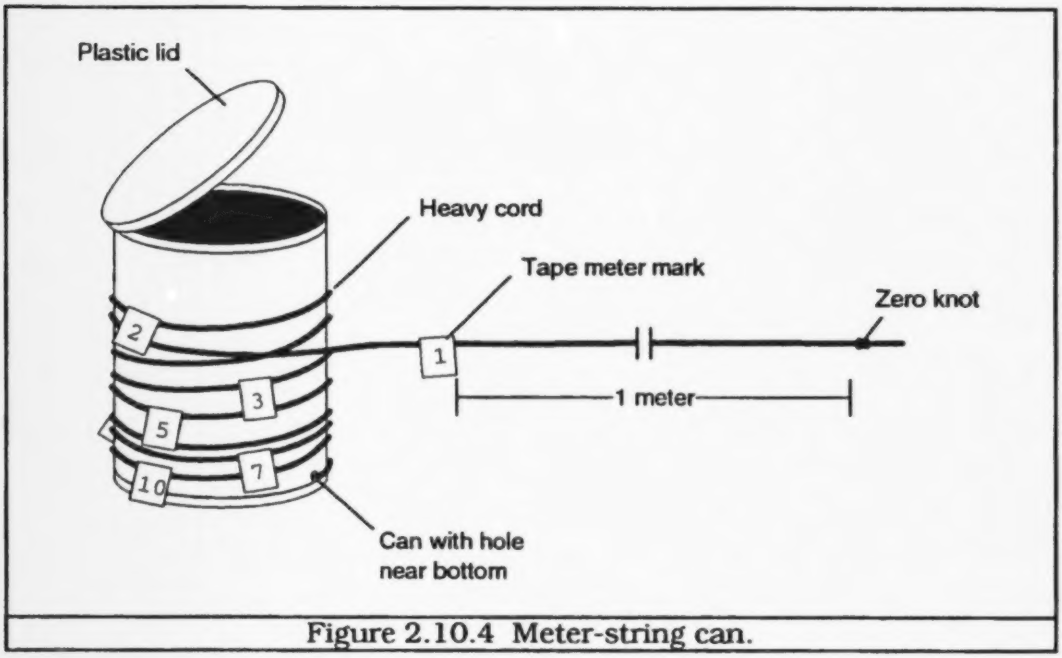
Plastic lid
Heavy cord
Tape meter mark
Zero knot
2
1
3
5
7
10
1 meter
Can with hole near bottom

Figure 2.10.4 Meter-string can.

2.10.5 MEASURING VOLUME

OBJECTIVES

The students
- Make tools for measuring the volume of liquids.
- Standardize a scale for fractions of a liter or quart.
- Develop a working definition of volume.

BACKGROUND

In this activity the students make tools for measuring the volume of liquids and solids made of small particles. These measuring devices can be graduated in fractions of liters or quarts. The quart is used here for illustration, but a liter measuring device can be made the same way.

Liter and quart

It is important for the students to get a *feeling* for volume. In DASH 2 the near equivalence of the liter and the quart will be used to connect the common grocery store quart with the liter. Treat them as about equal. For mnemonic purposes the unit can be referred to as the *liter/quart*. The actuality of a liter being equal to 1.06 quarts is dealt with in DASH 4.

Standard Volume

It will make no difference to the work of students in DASH 2 if the class standard is a little different from a laboratory standard liter or quart. The important thing is that all the students in the class get the same approximate volume each time they make measurements. A rigid or stiff, wide-mouth, plastic container is suggested for this activity. Plastic mayonnaise containers work well.

Making the Class Standard Liter/Quart

To assure consistency make one class standard liter/quart. Use a quart container of liquid and mark the level on the side with a permanent marker before emptying the bottle. Label this container as the class standard liter/quart. *Alternatively* if wide mouth liter containers are available, use a liter bottle of liquid to make the class standard liter/quart.

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Making Liter/Quart Graduates

Have the students make liter/quart graduates using volumes of liquid taken from the class standard liter/quart. Have them

- Run a piece of narrow masking tape down the sides of two quart or liter containers which have the same shape and dimensions.
- Fill the class standard liter/quart with water and then pour the contents into one of the quart containers. A few drops of food coloring makes the liquid level easier to see.
- Mark the water level on the tape and label it 1 liter/quart.
- Divide the water into two equal volumes by pouring half into the empty container. Mark 1/2 liter/quart on the tape. Mistakes are easily corrected by putting on another piece of masking tape.
- Empty one container and again divide the water in half. Mark on the tape 1/4 liter/quart. Again divide in half marking 1/8 liter/quart.

Table of Equivalent Measures of Volume

Metric		US System		
1 liter =	1000 milliliters =	about 1* quart =	2 pint =	4 cup
1/2 liter =	500 milliliters =	about 1/2 quart =	1 pint =	2 cup
1/4 liter =	250 milliliters =	about 1/4 quart =	1/2 pint =	1 cup
1/8 liter =	125 milliliters =	about 1/8 quart =	1/4 pint =	1/2 cup

*1 liter = 1.06 quarts

STUDENT ROLE

Instrument maker

MATERIALS

quart containers, plastic, wide-mouth, 2 per group
As an alternative use wide mouth liter containers
quart container of liquid, unopened for standard.
1/2-inch wide masking tape
plastic straws or eye droppers
waterproof marking pens
water
food coloring (*optional*)
newspapers
towels
Connections Book
Student Page 2.10.5 MEASURING VOLUME

PRODUCTS

Graduated containers
Completed Student Pages

PROCEDURES

1. **Introduce the activity when the students need a way to measure the volumes of liquids or fine grain solids like sand.**

   Prepare ahead of time the class standard liter/quart volume of water. See Background.

   - Run a narrow piece of masking tape down the side of the container but do not mark the water level.

   - Put a lid on the container and set it aside until the inquiry begins.

2. **Discuss with the students that they need to measure amounts of liquids but first they need to know what *volume* is.**

   Ask such questions as these:
   - What is the size of the milk container in your school lunch?
     ✔ Get agreement that it is a half pint.

   - How much milk fits into a 1/2 pint carton?
     ✔ Get agreement that 1/2 pint of milk is in a 1/2 pint container.

   - Does anyone know of another name for the measurement of the amount of a liquid that will fit in a certain sized container?
     ✔ Work for the term *volume*, providing the term if it is not suggested.
     ✔ Point out that you say the volume of milk you drink at lunch is a 1/2 pint.

   - Does anyone know of another size of volume measurement?
     ✔ Work for quart, pint, liter, and so forth.

3. **Show the students the standard 1 liter/quart of water or soda. State or read from the label that the volume of the container is a quart which is about the same as a liter.**

Ask such questions as these:
- How could you use this container and always be sure to put the same volume of water in it?
  ✔ Work for the idea of marking the tape so you can always put in the same volume of water.
  ✔ Have a student mark the level of the water in the standard and label it 1 liter/quart.
  ✔ This becomes the Class Standard Liter/Quart container.

- How could you use this container and always get the same volume of water out of it?
  ✔ Work for the idea of filling it to the mark and always completely emptying the water out of the container.

4. **Give each group 2 empty liter/quart containers and have them prepare each container for marking volumes. Have them pour 1 standard liter/quart into one of the containers.**

Help them
- Place a piece of narrow masking tape down the side of each container.

- Invent ways of checking to see that different groups have the same standard amount of water in one container.
  ✔ Work for such things as comparing the water levels or marking the liter/quart level on a container to see if another container's liter/quart of water comes to the same level, and so forth.

- To transfer small amounts of water between containers, use a straw or eyedropper.
  ✔ If needed demonstrate how an open straw can be pushed into water, then closed off by covering the open end with a finger, transfer the captured water to the other container, and finally release the water by taking the finger off the top of the straw.

- Mark and label the 1 liter/quart level on their containers or graduates.

- Share how they made their comparisons.

5. **Have the students invent their own ways to divide the volume in their graduate in half.**

Help them

- Try pouring the water from one container to the other.
  ✔ If the students spill the contents have them clean up spills and start over.

- Judge equal heights in the two containers.
  ✔ Use the straw to refine the transfer process.
  ✔ Check the water levels at eye level by moving the eyes (head and body) down to the level of the water on the table.

- Label this volume 1/2 liter/quart.

- Check the volume with other groups and adjust as needed.

6. **Have the students invent ways to divide the 1/2 liter/quart volume again in half to produce a 1/4 liter/quart volume. Check the volume with other groups and adjust as needed.**

7. **Have the students invent ways of dividing the 1/4 liter/quart volume again in half to produce a 1/8 liter/quart volume. Check the volume with other groups and adjust as needed.**

8. **Have the students invent ways to measure and mark 3/4 liter/quart on their graduates. Check the volume with other groups and adjust as needed.**

9. **Have the students invent ways to measure and mark 3/8, 5/8, and 7/8 liter/quart on their graduates. Check volumes with other groups and adjust as needed.**

10. **Have the students find the volume of assorted containers using their graduates. Identify each container with a letter or number.**

    Have them

    - Record their measurements on Student Page 2.10.5 MEASURING VOLUME.

    - Check their measurement with each other and correct them as needed.

11. **Have the students define volume for their Working Dictionary?**

    - Work for such things as volume is a measurement of the amount of a liquid that will fit in a certain sized container; is the space that some thing fits in; is a measurement of the space something fits in; and so forth.

12. **After the students have made all their measurement devices, have them discuss the importance of measurement. Record their ideas in the Connections Book.**

    Ask such questions as:
    - Who needs to measure things? What do they measure?
    - Why to people need to know how to measure things?

EXTENSION

- Challenge students to mark their graduates in 100 millimeter units.

2.10.6 SAFETY EQUIPMENT

OBJECTIVES

The students
- Discuss the need for classroom safety.
- Make plastic-bag raincoats.
- Invent protective aprons.
- Invent devices for handling hot objects.
- Make shields to protect their eyes from liquids with the help of DASH 5 students

---

BACKGROUND

This activity is used whenever new safety devices are needed. Safety is a constant focus in DASH. To raise the level of awareness about things that are potentially dangerous the students make their own protective equipment. They are responsible for determining when such gear should be used and what its limitations are in protecting them. This of course does ***not*** take the primary responsibility for safety from the teacher, but it does provide many hands and eyes all trained to watch for safety hazards.

Safety Team

In this activity a safety team of two or more students is appointed each week to watch out for safety problems and alert the class when safety precautions should be taken. Make membership on this team a Responsibility Chart assignment.

Raincoats

DASH students have been making emergency raincoats from plastic bags since kindergarten. These can be made when a student does not have the proper covering to work in the rain. The students invent their own designs. Utility should be stressed. After use raincoats should be dried, folded, and stored for other emergency occasions.

Aprons

Students need plastic-bag aprons for work in the classroom and field. They can invent their own design. Utility is stressed. The aprons should be cleaned after use and stored.

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Hand Protection
Hot pads and other devices to handle hot materials can be invented by the students. These also should be cleaned and stored after use. Commercially available plastic gloves can be used for sanitation purposes. In some cases a plastic bag to cover the hands can be substituted.

Face Shields
Shields to protect the face and eyes against flying objects and liquids can be made if experienced DASH 5 students are available to help. Otherwise use commercial goggles. The students should be given the latitude to invent any kind of shield as long as the eyes and face are protected. Procedure 6 lists the necessary safety features for the face shield.

Tool Safety
DASH 2 students are introduced to the use of several hand tools including saws, drills, and miter boxes. Safe use of all tools should be discussed and demonstrated before use. Adult supervision is essential until the students become skilled and responsible in tool use. Thereafter, teachers need to be aware of student use of tools and prepared to take quick action when they are being used improperly. Parents can make an important contribution to supervision.

STUDENT ROLES

Safety officer
Inventor
Safety-conscious worker

MATERIALS

chart paper
markers
Responsibility Chart
heavy-duty plastic bags, 20–30 gal
waterproof tape
cloth scraps

For face shields
- heavy-weight cord
- plastic containers, 1–2 gal (milk, bleach, etc.)
- heavy, clear plastic for eye shield window (clear plastic bottles, overhead masters, etc.)
- duct tape
- soft foam rubber or sponge
- rubber bands
- scissors
- razor blade or sharp knife for the initial cut in plastic (Teacher use only.)

Connections Book
Student Page 2.10.6 SAFETY HAZARDS

PRODUCTS

Concept map about classroom safety hazards
List of classroom safety rules
Raincoats
Aprons
Devices to handle hot materials
Face shields
Completed Student Pages

PROCEDURES

1. **Have the class develop a Concept Map about classroom safety hazards. Student Page 2.10.6 SAFETY HAZARDS can be used first to brainstorm.**

   Help them include such ideas as
   - Slippery floors.
   - Hot things.
   - Things that can get into eyes.
   - Things that can be tripped over.
   - Sharp and pointed things in desks.
   - The way equipment is used.
   - Misuse of sharp tools.

- Things that can fall over.
- Wet clothes.
- Clogged drains.
- Clutter.
- Blocked exits.

2. **Introduce and discuss the need for a safety team to remind the class about safety rules.**

   Have the students
   - Use their Concept Map to develop a list of class safety rules.
   - Add the safety team to the Responsibility Chart.
   - Write a job description for the safety team.
   - Listen to and discuss the safety team's report each week.
   - Revise the job description as necessary.

3. **When an activity requires protecting clothes, have the students invent aprons. Use the Inventor's Box and emphasize utility of design.**

   Ask such questions as these:
   - What materials can protective aprons be made out of?
     ✔ Work for agreement on the use of plastic.
   - What should be done with the aprons after they've been used?
     ✔ Work to the idea of cleaning and storing them for later use.

4. **When an activity calls for going outside in the rain, have the students who have no raincoats invent them. Use the Inventor's Box and emphasize utility of design.**

   Ask such questions as these:
   - What can raincoats be made out of?
     ✔ Work for agreement on large plastic bags.
   - What precautions do you need to take when you put a plastic bag over your head?
     ✔ Get at the need for air holes.

- What should be done with your raincoats after you use them?
  ✔ Work to the idea of drying and storing them for later use.

5. **When an activity requires students to handle hot materials, have them invent hot pads or other devices. Use the Inventor's Box.**

   Ask such questions as these:
   - What materials could be used to invent devices to handle hot things?
     ✔ Work toward the idea that the materials should not be destroyed at the temperature of the item being handled. Cloth or wood can be used at lower temperatures. At higher temperatures metal or ceramic materials should be used.

   - What should be done with the holders after they have been used?
     ✔ Work to agreement on cleaning and storing them for later use.

6. **When an activity requires protection of their face and eyes, have the students make face safety shields. Have them work with experienced DASH 5 students to help in the invention and crafting process. Otherwise use commercial goggles. See Figure 2.10.6.**

   Have the students test their shields before use for the following safety features:
   - Material used for the plastic window should be clear and capable of withstanding a direct blow without cracking.
     ✔ Plastic from clear soda bottles will normally suffice.

   - The plastic window should be wide and broad enough to look in all directions.

   - The plastic window should not allow liquid to come in directly or around the sides.

   - The shield should not slip off of the head.
     ✔ Rubber bands and foam rubber can be used to secure the shield.

   - The lid should be left on the spout to completely enclose the top of the head if the upright model is used.

   - Shields should be cleaned, inspected, and stored after use.

7. **Have the students discuss and extend their ideas about safety hazards and equipment. Record their ideas in the Connections Book.**

   Ask such questions as these:
   - Why is it important to know about safety hazards?
   - Who else needs to know about safety hazards? Why?
   - Where else might our classroom safety rules apply?
   - Where else might you need to invent safety equipment?

EXTENSIONS

- Have students design other safety equipment such as foot coverings as needed.
- Have the students write aphorisms for their classroom safety rules.

ILLUSTRATION

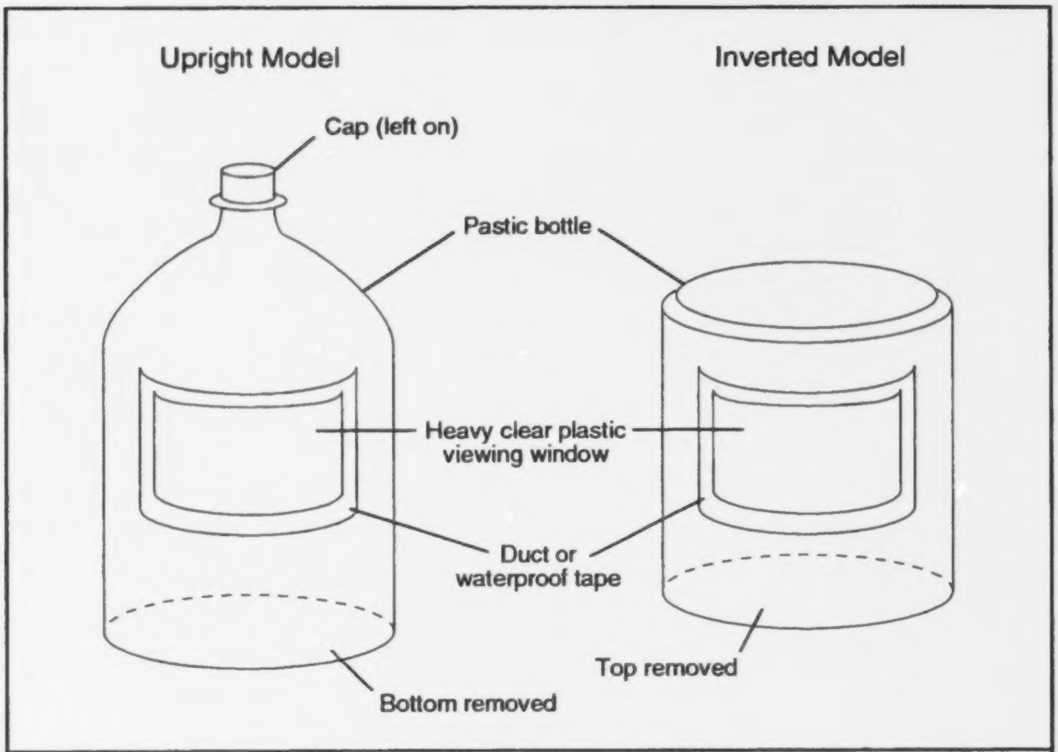

Upright Model
Inverted Model
Cap (left on)
Pastic bottle
Heavy clear plastic viewing window
Duct or waterproof tape
Top removed
Bottom removed

Figure 2.10.6 Face shield.

DASH

MY DESK ORGANIZER
SP 2.10.1

Name: ______________________

Date: ______________________

Draw and label your desk organizer.

DASH

NOTEBOOK ORGANIZATION
SP 2.10.2

Name: ____________________

Date: ____________________

Tell how you organized your notebook. Draw and label a picture to help explain your organization.

DASH

WEIGHTS
SP 2.10.3

Name: ______________________

Date: ______________________

Object Weighed	Number of Units	Mass Unit

DASH

MEASURING LENGTH
SP 2.10.4

Name: ______________________

Date: ______________________

FROM WHERE?	TO WHERE?	HOW MANY METERS?

MEASURING VOLUME
SP 2.10.5

Name: ______________________

Date: ______________________

CONTAINER	VOLUME

DASH

SAFETY HAZARDS SP 2.10.6

Name: ______________________

Date: ______________________

Make a list of all the possible safety hazards you can think of in the school environment.

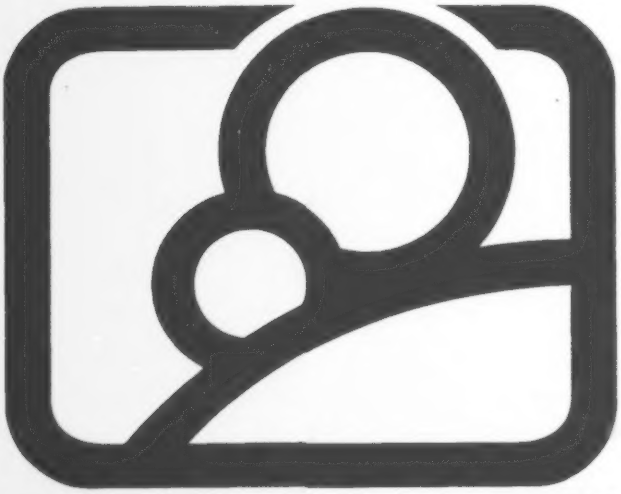
LOCATION	POSSIBLE HAZARD

DASH

GRADE 2

SUPPORT MATERIALS

Grade 2
Start-Up Activities



DASH

Developmental Approaches in Science, Health and Technology

Curriculum Research & Development Group
University of Hawai'i

DASH

GRADE 2

START-UP ACTIVITIES & STUDENT PAGES

DASH

GRADE 2

TABLE OF CONTENTS

START-UP ACTIVITIES
&
STUDENT PAGES

1.	SU.1	Classification
2.	SU.2	Working Definitions
3.	SU.3	Living and Not Living
4.	K.1.7	Moon Phases
5.	1.2.12	Moonrise and Moonset
6.	1.2.6	Timeline
7.	1.2.8	Night and Day
8.	1.8.1	Temperature of Things
9.	K.3.8	How Bugs Walk
10.	K.3.9	Parts of Bugs
11.	K.4.4	Growing Bean Sprouts
12.	1.4.6	Plant Life Cycle
13.	1.10.3	Testing for Water
14.	1.10.7	Bubbles in Water
15.	1.10.8	Bubbles in Air

SU.1 CLASSIFICATION

OBJECTIVES

The students
- Use their senses to describe selected objects.
- Identify the different senses used in collecting the information.
- Relate physical properties of things to senses.
- Classify a collection of items according to their similarities and differences.
- Are introduced to two category classification or dichotomous classification.
- Classify objects by their physical properties.
- Identify both similarities and differences in functions of items.
- Classify items by their functions.

BACKGROUND

This start-up activity is designed to introduce students new to DASH to the fundamental science concept and skill of classification. The teacher will need to adapt and modify the suggested procedures depending on the previous experience and developmental level of the students.

Senses and properties

The students first make a concept map about the senses of sight, hearing, touch, smell, and taste. They associate these senses with their sensing organs—eyes, ears, skin, nose, and tongue and identify the properties of objects that can be sensed—color, sound, texture, temperature, odor, flavor, and so forth.

Same and Different game

The students next play the Same and Different game in which they sort items into six or more different major categories. Each major category is made up of some set of common classroom items such as paper clips, books, pencils and so forth. Objects in a category have the same form and function. The *form* of an object refers to its physical properties, what it is made of, and its parts and their organization. The *function* of an objects refers to what it does or is used for.

Kinds of things or categories

The teacher and students work together to create category names such as pencils, rulers, paper clips and so forth as two or three different kinds of things or items are drawn from a container holding a Master Collection.

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The students then match other items with existing categories or create new categories when different kinds of items are presented. The students can also invent logos to represent each category—example, a picture of a pencil or a ruler.

Building a Master Collection

Most of the procedures in this activity use a master collection of items. It needs to be large enough so there is at least one item per student. Needed for the master collection are 6 or more major categories, each with two subcategories. One of the two subcategories has items that all look the *same*. The other subcategory has the same kind of items but they look *different* from all other items. For example, the major category pencils could have a *same* pencils subcategory—two brand new white pencils and a *different* pencils subcategory —four to eight used, different colored pencils. See Figure SU.1(1) for some suggestions for a master collection.

Category: Pencils Subcategories: 2 New pencils that look the same. 4-8 Used pencils, each different from all other pencils. (e.g. different colors, lengths)	Category: Paper Clips Subcategories: 2 New paper clips that look the same. 4-8 Paper clips, each different from all other paper clips (e.g. different colors, sizes)
Category: Books Subcategories: 2 New books that have the same title. 4-8 Used books, each with a different title.	Category: Rulers Subcategories: 2 New rulers that look the same. 4-8 Used rulers, each different from all other rulers (e.g.. different colors, materials)
Category: Paper Subcategories: 2 New sheets of paper that look the same. 4-8 Used sheets of paper, each different from all other sheets of paper. (e.g. different colors, sizes)	Category: Crayons Subcategories: 2 New crayons that look the same and have the same color. 4-8 Used crayons, each different from all other crayons. (e.g. different colors, lengths)

Figure SU.1(1) Six possible categories of game items for a master collection.

Physical properties and two category classification

Next the students use the physical properties of size, shape, and other visual and tactical characteristics to separate items into subcategories. To do this they are first introduced to a two category or dichotomous system for sorting or classifying items. Scientists use a simple two category or dichotomous system to sort or classify things. They take a collection of items, inspect it, and divide the collection into two different categories. One category has a distinct characteristic and the other does not have that characteristic.

Name Game

To get a feeling for the dichotomous classification system, start with the Name Game. Select four or five students and group them in the inclusive category *All Students*. For example, *All Students* might be Jan, Jack, Jill, Jo, and Jim. Then divide *All Students* into two categories—*Jan* and *Not Jan*. Next divide *Not Jan* into two more categories—*Jill* and *Not Jill*. Continue the process until *Jo, Jack* and *Jim* have their own separate categories. See Fig. SU.1(2).

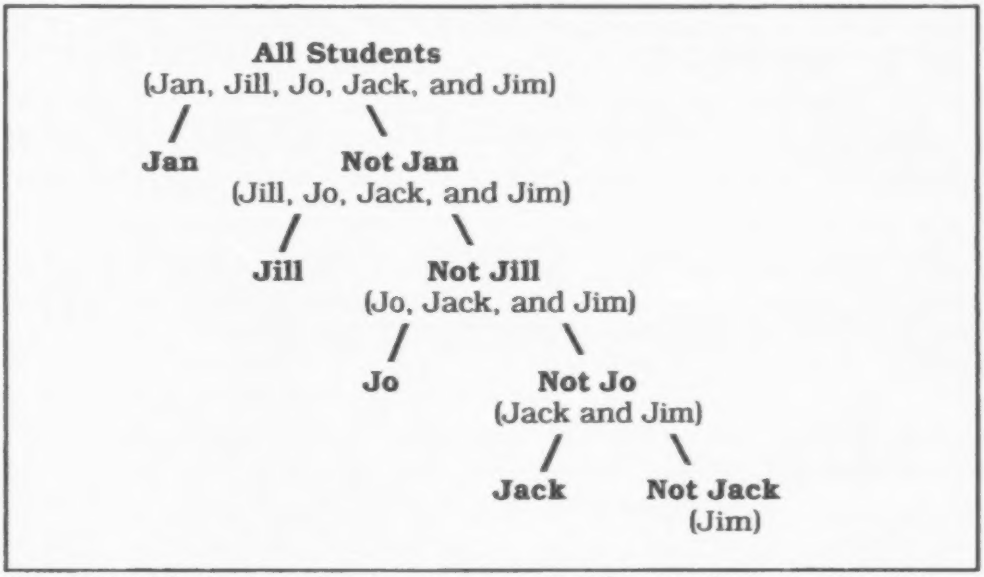

Fig. SU.1(2) A classification tree sorting five students in the Name Game using a two category or dichotomous system.

Classification game

Use the items from the Master Collection for the classification game. Have the students classify the objects by their physical properties or *forms*. First the students work with the teacher on one of the major categories such as pencils. Together they successively divide the items in the major category into pairs of sub-categories using differentiating physical properties. After the students have worked through classification of one major category, have them work in small groups to classify other major categories.

Follow the process used in the Name Game. On a table or the floor put all of the items in a single major category. *All pencils* are shown in the example in Fig. SU.1(3). The first two subcategories of *All Pencils* are

White pencils and *Not white pencils*. Then the *Not white pencils* are divided into two subcategories—*Yellow pencils* and *Not yellow pencils*. Again the division continues until the items can no longer be separated. Here the pencils were separated by the physical property of color. Multiple physical properties such as color and length, can be used within the same category classification as desired.

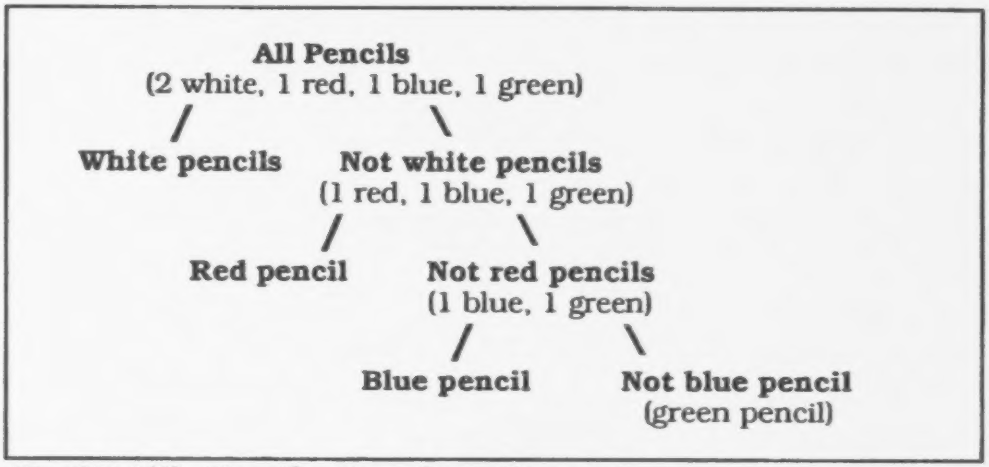

Fig. SU.1(3) Classification of pencils using a two category or dichotomous system and a classification tree.

Showing steps in the classification
The students are then asked to help draw a diagram showing the steps they went through to identify different objects as in Figures. SU.1(1–2). This creates a *classification tree* by connecting the words or boxes with lines to show the division of categories. The students record their categorization on a class chart. Then they work in small groups to classify other major categories and record their work on SP SU.1 CLASSIFICATION TREE.

Function classification game
Next the students are introduced to classification by *function*. First they work with the teacher to classify items and to get an idea of the meaning of the function of a thing or what it does or is used for. Then they work in small groups to classify sets of items by function.

Function game
The function game is played with one item from each of four of the major categories from the master collection. These are put on the table and the students find a functional category name that will fit them all. For example, for a collection of a pencil, ruler, crayons, and a piece of paper, the functional category could be *Things used in drawing* or *Classroom tools*. The students then classify the set into a pair of function subcategories labeling the function of one item and labeling the other as not having that function. For example; *Thing used in measuring* (ruler)

and *Things not used in measuring* (all other items). Words or logos are used to identify the function categories. Figure SU.1(4) shows some possible functions for items in the master collection. With the teacher, the students separate the remaining three items into functional subcategories. For example: *Things used to write on* (paper) and *Things not used to write on* (crayons and pencils). See Figure SU.1(5).

Item	**Possible Function**
Book	Items used to read, to hold printed words and pictures, to press flowers, etc.
Crayon	Items used to color paper, to batik, to color candles, etc.
Paper	Items used to write on, to make airplanes or spitballs, etc.
Paper clip	Items used to hold papers together, to release computer disks, etc.
Pencil	Items used to write on paper, to poke holes, to hold doors open, etc.
Ruler	Items used to measure distance, to draw straight lines, to make ramps for marbles, etc.

Figure SU.1(4) A list of some possible functions for the master collection.

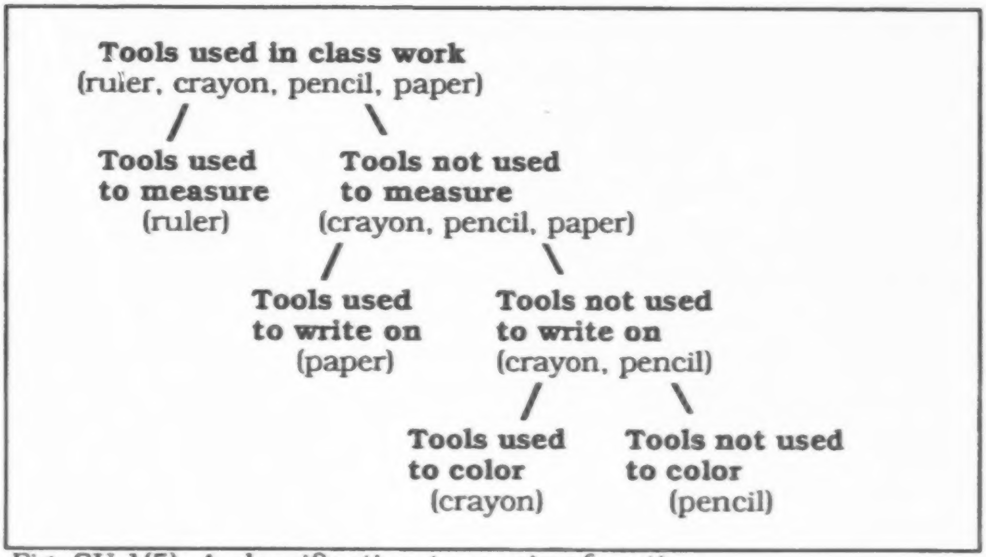
Tools used in class work
(ruler, crayon, pencil, paper)
Tools used to measure
(ruler)
Tools not used to measure
(crayon, pencil, paper)
Tools used to write on
(paper)
Tools not used to write on
(crayon, pencil)
Tools used to color
(crayon)
Tools not used to color
(pencil)

Fig. SU.1(5) A classification tree using function.

STUDENT ROLES

Observer
Classifier
Taxonomist

MATERIALS

chart paper
markers
items for the master collection
Student Page SU.1 CLASSIFICATION TREE

PRODUCTS

Class charts of classification using form and function
Completed Student Pages

PROCEDURES

1. **Have the students construct a concept map about physical properties and the senses.**

   Help them to include such ideas as these by asking questions about

- The sense of sight.
  ✔ Work to the idea that the eyes provide the sense of sight.
  ✔ Include sight associated physical properties such as color, size, shape, pattern and so forth.

- The sense of hearing.
  ✔ Work to the idea that you hear things with your ears.
  ✔ Include hearing associated physical properties such as pitch (high/low), intensity or amount (soft/loud/painful), beat (fast/slow), and so forth.

- The sense of touch.
  ✔ Work to the idea that you feel things with the skin.
  ✔ Include touch associated physical properties such as feeling texture (rough/smooth, soft/hard, sharp/dull, others), pressure (heavy/light/pain), temperature (hot/cold), and so forth.

- The sense of smell.
  ✔ Work to the idea that you smell things with the nose.
  ✔ Smells are described as being like something known–like fruit, perfume, or foul odors.

- The sense of taste.
  ✔ Work to the idea that you taste things with the tongue.
  ✔ Include touch associated physical properties such as sweet, sour, bitter, and salty.
  ✔ CAUTION: Remind students that it is dangerous to taste things that are not foods.

2. **Introduce the Same and Different game using items from the master collection. See Background. Keep items in a container so that they are seen only when pulled out. Have the students focus on the major category names (pencils, paper clips, paper, and so forth). Do not worry about subcategory differences at this time.**

   - Pull an item from the container and ask the students to give it a name.
     ✔ Ask, What is this? or what do we call this? The name they suggest will usually tell what kind of thing the item is and be its category name.

   - Draw a box or circle on chart paper and put the item in it. Label the box with the category name.

   - Show the students another item and ask them if it is the same or different from the one already out in the circle or box.

- If different, draw and place it in a different box or circle. Label the box with the new category name.
  ✔ Start using the term *category* to describe the box or circle and the items in it.

- If it is the same, place it in the box with the similar object.
  ✔ Start using the term *category* to describe the box or circle and the items in it.

- Ask why they put the item where they did?
  ✔ Usually students will say they look alike or do the same things.

- Ask why they didn't put the items in some other category?

- Continue until the students are reasonably fluent with the ideas of same, different, and category.

- Summarize the activity by asking what they mean when they say something is in a *category*. Ask them to give examples of categories and things that could be included in them.
  ✔ Work to such things as new, old, and used pencils are in the category pencils; new, old, and beat-up cars are all in the category cars. In each case members of the category share some properties and do the same thing.

- Help the students to understand the importance of knowing about physical properties by asking them how they tell one object from another.
  ✔ Work to describing the physical properties of the objects.

3. **Introduce the students to playing a Name Game.**

   - Draw a large circle on chart paper and give it the name *All Students*. See Fig SU.1(2).
     ✔ Ask for volunteers and select 4.
     ✔ Have the 4 students write their initials in the circle.
     ✔ Announce that this is the *All Students* circle and label it.

   - Draw another circle outside the big circle. Put the initials of Student #1 in the circle.
     ✔ Announce this is *Student #1's* circle. Label it.
     ✔ Ask if the big circle still has the correct name now that Student #1 is not in it.
     ✔ Work to the idea that they need a new circle that does *not* include Student #1.

- Draw a *Not Student #1* circle at the side of the *Student #1* circle. See Fig SU.1(2). Have the remaining students put their initials in the new circle. Ask what a name for the circle might be.
  ✔ Work to the response the *Not Student #1* circle. Label it.

- Draw another circle below the *Not Student #1* circle. Put the initials of Student #2 in the circle.
  ✔ Announce this is *Student #2's* circle. Label it.
  ✔ Ask if the *Not Student #1* circle still has the right initials now that Student #2 is not in it.
  ✔ Work to the idea they need a new circle that does *not* include Student #2.

- Draw a *Not Student #2* circle at the side of the *Student #2* circle. See Figure SU.1(2). Have the remaining workers put their initials in the new circle. Then ask the students to name the circle and label it.
  ✔ Work to the response the *Not Student #2* circle.

- Draw another circle below the *Not Student #2* circle. Put the initials of Student #3 in the circle.
  ✔ Announce this is *Student #3's* circle.
  ✔ Ask if the *Not Student #2* circle still has the right name now that Student #3 is not in it.
  ✔ Work to the idea they need a new circle that does *not* include *Student #3.*

- Draw a *Not Student #3* circle at the side of the *Student #3* circle. See Figure SU.1(2). Have the remaining student put initials in the new circle.
  ✔ Ask if is it fair to call this circle *Not Student #3* since all other students have their own circle.
  ✔ Work to the response that since only *Student #4* is in the circle it could also be called *Student #4's* circle.

- Help the students add connecting lines to the chart to show how the classification of students was accomplished. Introduce the term *classification tree* for this type of chart.

- Ask the students to tell what they think a classification tree can tell them.
  ✔ Work to the idea that it shows how you think as you make selections of things or people.

4. **Use the items from one of the major categories in the Master Collection and introduce the Classification Game. See Figure SU.1(3) for an example with pencils. Place all items on a piece of chart paper on a table or the floor and go through their classification with the students.**

Ask such questions as these:

- What is the name of the category?
  ✔ Write the name of the category in a box or circle containing all items.

- Can you divide these things into two categories so that things in one category will have a property and all the things in the other category will not have that property?
  ✔ Draw boxes or circle around the subcategories and help the students identify them with labels.
  ✔ The same name or logo is used for pairs of categories. Run a diagonal line through the *not* logo.
  ✔ Continue the subdivision and labeling as far as possible.
  ✔ Post the drawing showing the steps in subdivision.

- What did you use to separate one category of things from another?
  ✔ Work to the idea of using different properties of items.

- What kinds of properties did you use?
  ✔ Get at such things as differences in shape, color, materials, weight, size, and others.
  ✔ Give these things the names *physical properties* and *form.*

- How is this classification similar to the Name Game?
  ✔ Get at the idea that they are the same only one used people and the other objects.

5. **Organize the class into teams of 4–5 students. Give each team one of the major categories of things from the master collection. Have them classify the items, recording the steps and categories on a classification tree using Student Page SU.1 CLASSIFICATION TREE.**

   Have the students

   - Divide their major categories into two subcategories so that things in one subcategory have a property and things in the other category do not have the property.

   - Draw boxes, connecting lines to show steps, and create identifying names or logos.

   - Continue the subdivision as far as possible.

   - Exchange classification sets and repeat the process.

6. **Use the master collection of items and introduce the Function Game to the class. Put four items from four different major**

categories on chart paper on a table or the floor. See Figure SU.1(5).

Ask such questions as these:

- What do you use these things for?
  ✔ Get at such things as using them as classroom tools, using them to do work at school, or using them as tools in an office.

- Does anyone know a word for the *uses of things*?
  ✔ Get students suggestions and home in on *function.*
  ✔ Draw a box or circle around the items and label the collective function category.

- Can you divide these things into two categories so that things in one category have a special function and things in the other category do not have that function?
  ✔ Discuss possible divisions. If the students do not come up with an idea suggest one yourself. See Figure SU.1(4).
  ✔ Draw boxes or circles around the subcategories and help the students identify them with function names.
  ✔ Continue the subdivision as far as possible.

- Can someone draw lines to show the steps used in the classification?
  ✔ Help the volunteer draw lines between the boxes or circles.
  ✔ Post the chart showing the steps in subdivision using function.

7. **Organize the class into teams of 4–5 students. Give each team four to six items from the different groups and a sheet of paper or Student page SU.1 on which to draw their classification steps or tree. Have them play the Function Game.**

- Help them give their total collection a category name based on function.
  ✔ It can be the same as the one used in the introduction.

- Help the students divide their categories into two subcategories so that things in one subcategory have a function and things in the other category do not have that function.

- Help them draw boxes or circles, connect lines to show steps, and create identifying names as needed.

- Help the students continue the subdivision until each item has its own functional subcategory.

- Summarize the game.

✔ Ask if they have seen other trees like the one from the Function Game. Bring out the Name Game and physical properties classification trees.

✔ Ask how the trees are alike. Get at the idea that they are all used to sort and classify.

✔ Ask them what is meant by *category. Form. Function.*

- Summarize the importance of knowing about form and function.

  ✔ Ask the students how they use function in making their selection of items needed to go back to school. Work for selecting items to write with such as pens and pencils, things to write on such as paper and notebooks, and so forth.

  ✔ Ask the students how they use form in making their selection of items needed to go back to school. Work for selecting colors of pens, shapes of erasers, sizes of paper, and so forth.

DASH

CLASSIFICATION
TREE
SP SU.1

Name ____________________

Date ____________________

SU.2 WORKING DEFINITIONS

OBJECTIVES

The students
- Review the components of a working definition—form, function, and category.
- Practice making working definitions.
- Start to compile a working dictionary.

BACKGROUND

In this start up activity students new to DASH review the concepts of form, function and category introduced in Activity SU.1 CLASSIFICATION. They then use these ideas to identify the components in working definitions and to write some of their own.

Working definitions

Scientific progress relies on *working definitions* or operational definitions which describe the current understanding of a concept or term. These definitions are called *working* because they allow the work of science to go on, understanding that the definition may be changed or modified in the future.

Students' definitions

Research on children's development of definition indicates that the ideas they have about the world are constantly changed or modified by experience. DASH has called on these findings for guidance and therefore uses working definitions to support the students' continual shaping and reshaping of concepts and ideas.

A record of working definitions gives the students a way to keep track of their evolving thinking and learning. Working definitions provide teachers a window into the student's or the class's grasp of ideas. There should be a review of previous definitions whenever an already-defined concept re-emerges. When reviewed, a definition can be added to or changed.

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Focus Book
If available from a DASH kindergarten teacher, the Focus Book, *THE FRIENDLY SHAPE*, can be used with younger students to help them get a sense of working definitions. See Activity K.1.10 WORKING DICTIONARY AND WORKING DEFINITIONS in the *DASH Kindergarten Teacher Guide* for suggestions on using this book.

Evolving definitions
Beginning working definition may include only a category name and the thing's functions. For example: *A living thing grows, reproduces, and is a user of water.* Just as common a beginning working definition may include only a category name and the thing's forms. For example: *A living thing is made of wood or meat.* A more advanced working definition would join these pieces. *A living thing* (category name) *is made of wood or meat* (forms) and *grows, reproduces, and needs water* (functions). Beyond this simple model, a maturing working definitions may also include examples, synonyms, pictures or diagrams, and other information. Pictures and drawings in particular greatly enhance deeper understanding of a working definition.

The Working Dictionary
The Working Dictionary is most often a book with blank pages, frequently loose leafed or big book format, used to keep a record of definitions. It is suggested that a single page be devoted to each concept or term defined so that ideas can be added or changed. Entries should be dated. Initials of major student contributors can be added to help the teacher in assessment of student understanding. Working definitions *can include incorrect information* since definitions will undergo regular re-evaluation at which time corrections can be made. This is how science operates—it is always changing, growing, refining.

STUDENT ROLE

Lexicographer

MATERIALS

Focus Book *THE FRIENDLY SHAPE* (Optional)
master collection from Activity SU.1 CLASSIFICATION
chart paper
markers
Student Page SU.2 WORKING DEFINITION

PRODUCTS

Working definitions
Completed Student Pages

PROCEDURES

1. **Review the ideas developed in Activity SU.1 CLASSIFICATION with the students.**

   Ask such questions as these:
   - What does *category* mean? Can you give some examples.
     ✔ Work for the name for the group to which something belongs.
     ✔ Use the master collection from SU.1 to help students come up with concrete examples.

   - What is meant by *form*? Can you give some examples?
     ✔ Work for the physical characteristics of the thing, the materials from which it is made, and the parts of which it is made up.

   - What is meant by *function*? Can you give some examples?
     ✔ Work for the use of the thing or what it does.

2. **Introduce the students to the idea of a working definition by reading some and having them identify the three parts. Working definitions include a category or name; a function or what the thing does or how it is used; and its form or physical properties, materials it is made of, and its parts or components.**

Use such definitions as these:

- A refrigerator is an appliance used for keeping things cold and making ice. It is usually box-shaped, comes in many colors, has a door with a handle and shelves, and needs electricity to operate.

- Markers are writing tools that come in many colors. They have different sized tips and usually look like pens. They can be washable or permanent and often have special smells. They can be used for writing or drawing on all sorts of things such as paper, clothing, and people.

- Spoons are kitchen utensils used for eating, serving, measuring and stirring. They can usually be held in one hand. They are made from metals, ceramic materials and plastic. They usually have a handle to hold on to with a bowl-shaped part at one end.

3. **Help the students write a working definitions for one of the items in the master collection from Activity SU.1 CLASSIFICATION. Record their definition on chart paper. Have them identify the category, form, and function by circling each in a different color.**

4. **Have the students work in small groups to write working definitions for other items in the master collection from Activity SU.1 CLASSIFICATION. Use Student Page SU.2 WORKING DEFINITION. Have the groups exchange papers and identify the category, form, and function in the other group's definition by circling each in a different color.**

5. **Introduce the Working Dictionary to the students when writing class working definitions. See Activity SU.3 LIVING AND NOT LIVING.**

6. **At the end of the school year store the Working Dictionary in the library for the students to build on the next year.**

DASH

WORKING DEFINITIONS
SP SU.2

Name ______________________

Date ______________________

SU.3 LIVING AND NOT LIVING THINGS

OBJECTIVES

The students
- Collect living and not living things.
- Describe and identify living, not living, never-living, once-living, and combination things and plants and animals.
- Write working definitions for living, not living, never-living, once-living, and combination things and plants and animals.

BACKGROUND

This start up activity follows Activities SU.1 CLASSIFICATION and SU.2 WORKING DEFINITIONS. This activity provides practice in classifying and writing working definitions as well as introducing several fundamental science concepts—living, not living, plants, animals, once-living and never-living. LIVING AND NOT LIVING THINGS also provides an opportunity to introduce the Wonder and Discover Book to students new to DASH.

The students first collect living and not living things. They classify their items to include the categories—living, not living, plants, animals, once-living, never-living, and combination things. Then they write class working definitions for these terms.

Student classification and working definitions

The concepts being introduced here are some of the most complex and difficult ones in science. The correctness and completeness of the classification and definition procedures suggested here will depend upon the prior experience and developmental level of the students. It is important to keep in mind that scientists themselves are not in complete agreement about these ideas. When questions arise they should be recorded in the Wonder and Discover Book.

STUDENT ROLES

Scientist
Classifier
Lexicographer

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MATERIALS

chart paper or a large sheet of oaktag
markers
clear plastic cups
recycled nylon stockings
baggies
3 X 5 cards
Working Dictionary
Wonder and Discover Book
Student Page SU.3 THE COLLECTION GAME

PRODUCTS

Classification chart about living and not living things
Working Definitions
Completed Student Pages

PROCEDURES

1. **Introduce the collection game. Have the students work in teams of two.**

   - Ahead of time divide a piece of chart paper in half. Label the two columns *Living* and *Not living*. Put the paper on a table. Figure SU.3 shows a suggested model for a finished chart. ✓ You may want to add a few items to the collection if the students do not collect them—something metal, a small rock, something plastic, a dead leaf, a dry seed, a piece of paper, a wood pencil with a metal eraser band, and a wood clothespin with a metal spring will help encourage the discussion.

   - Give each team a clear plastic cup or other container.

   - Have the students cover the cups with a piece of nylon stocking to let any animals they might collect breathe.

   - Instruct teams that they are to go outside and collect one living and one not living object to put in their container.

   - Have the students place their collected items in either the living or not living category on the chart paper.

2. **Discuss and expand the classification with the students.**

- Have them look at the items in each category and ask if they all agree with how things have been classified. Have the collector defend his choice of category.

- When there is agreement, have the students look at the living category and ask how it could be divided into just two groups.
  ✔ Work for *Plants* and *Animals*. There will hopefully be some disagreement from the purists who will suggest *Plants* and *Not plants* or *Animals* and *Not animals*. If needed remind the students of their two category or dichotomous classification activities. Both are correct although *Plants* and *Animals* are more commonly used.

- Divide the *Living* category column in two parts and label. Have the students place their living things into the two new categories.
  ✔ When they all agree, ask a few questions yourself about the dead leaf in the living category, the seed, and so forth.
  ✔ When there are unresolved questions, record them in the Wonder and Discover Book and create a new category for questionable items.

- Have the students look at the *Not living* collection. Ask if there is a way to divide the items into just two categories. Ask a specific question about the dead leaf and the piece of metal if needed.
  ✔ Work for the ideas of *Never-living* and *Once-living* things.
  ✔ There may again be some discussion from the purists who prefer *Once-living* and *Not once-living*. This is also correct although the former is more commonly used.

- Divide the *Not living* category column in two parts and label. Have the students place their not living things into the two new categories.
  ✔ When they all agree, ask a few questions yourself about the plastic in the never living category, the seed, and so forth.

- Pick up the pencil, clothespin or other combination item and ask where it belongs. Help the students to invent a Combination category and add it to the chart.

- Have the students attach items to the chart.
  ✔ Draw pictures of any live animals and return them to where they were collected.
  ✔ Bulky items can be placed in baggies and attached to the chart.

4. **Have the students write working definitions for living, not living, once-living, never-living, and combination things and plants and animals. Remind them to include category, form, function, and examples.**

   - Divide the class into seven groups and assign them a color to write with.

   - Give each group a sheet of paper from the Working Dictionary with a different category to define from the above list.

   - Have them write a working definition in their assigned color for their term.

   - After ten or so minutes have them pass their papers to another group in a round-robin fashion. The new group may make additions and corrections to the definition using their assigned color.

   - Continue this passing process every 2 to 3 minutes until all groups have worked on all the definitions or time runs out.

   - Have the original groups share the completed definitions, ask for any further input, and put the pages in the Working Dictionary.

5. **These definitions should be returned to periodically for revision.**

ILLUSTRATION

<table>
<tr><th colspan="4">All Things
(Matter)</th></tr>
<tr><th colspan="2">Living Things</th><th colspan="2">Not Living Things</th></tr>
<tr><th>Animals</th><th>Plants
(Not Animals)</th><th>Once Living Things
(Not Never Living)</th><th>Never Living Things</th></tr>
<tr><td rowspan="3"></td><td rowspan="3"></td><td></td><td></td></tr>
<tr><th colspan="2">Combination Things</th></tr>
<tr><td colspan="2"></td></tr>
<tr><th colspan="4">Wonder and Discover Things</th></tr>
<tr><td colspan="4"></td></tr>
</table>

Figure SU.3 A suggested model for a completed chart about classifying living and not living things.

SP SU.3

DASH

LIVING AND NOT LIVING SP SU.3

Name ____________________

Date ____________________

<table>
<tr><td colspan="4">All Things
(Matter)</td></tr>
<tr><td colspan="2">Living Things</td><td colspan="2">Not Living Things</td></tr>
<tr><td>Animals</td><td>Plants
(Not Animals)</td><td>Once Living Things
(Not Never Living)</td><td>Never Living Things</td></tr>
<tr><td rowspan="3"></td><td rowspan="3"></td><td></td><td></td></tr>
<tr><td colspan="2">Combination Things</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="4">Wonder and Discover Things</td></tr>
<tr><td colspan="4"></td></tr>
</table>

DASH K.2.7 MOON PHASES

OBJECTIVES

The students
- compare time between two full moons with the time between two new moons
- observe, report, and record phases of the moon from new moon to new moon
- sequence moon phases
- identify the moon cycle as one of nature's clocks
- make a Moon Clock

BACKGROUND

MOON PHASES should follow Activities K.1.1 THE LEARNING CALENDAR, K.2.2 BEGINNINGS, K.2.3 ENDINGS, K.2.4 DAY AND NIGHT, K.2.5 DAYS, WEEKS, AND MONTHS, and K.2.6 MOON WATCH and should precede K.2.9 CLOCKS AND CALENDAR. In MOON PHASES the students again observe the phases of the moon starting with the new moon and then construct a Moon Clock. Families are once more asked to participate.

Connections with MOON WATCH

In the previous activity, K.2.6 MOON WATCH, the students counted the days between two *full* moons. Here they count the days and watch the phases between two *new* moons. The students find that the period of time between the new moons is about the same as the period between full moons. Special focus here is on the phases of the moon and their order. Observations are used to help make a Moon Clock.

Moon phases

The moon phases follow in an ordered sequence. Starting with the new moon there are eight phases; the first crescent phase, the first quarter phase, the first gibbous phase, the new moon, the last or shrinking gibbous phase, the third quarter phase, the last crescent phase, and then back to the new moon. See Student Page K.2.7E MOON PHASES AND SHAPES. More formal study of moon phase will be carried out in *DASH 1*.

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When to use

MOON PHASES can be used anytime after Activity K.2.6 MOON WATCH; however, to get maximum reinforcement of ideas it is best done in the next moon cycle. If the students are already doing a second full-moon-to-full-moon day count as a continuation of K.2.6 MOON WATCH, continue it and concurrently begin the new study. Emphasize that this is a different count with different objectives. The students are now trying to find out whether the day counts between full moons and between new moons are the same or similar and the sequence of phases in the moon cycle.

STUDENT ROLES

Astronomer
Record keeper
Chronologist
Clock maker

MATERIALS

Learning Calendar
markers
crayons
glue
paper plates
brass fasteners
index cards
hole punch
chart paper
letter to families

Student Pages	K.2.7 A NEW MOON
	K.2.7 B-C SEQUENCE CARDS
	K.2.7 D MOON CLOCK
	K.2.7 E MOON PHASES

PRODUCTS

Class chart about moon phases
Moon Clocks (several will be needed in Activity K.2.9)
Completed Student Pages

PROCEDURES

1. **Review the results of Activity K.2.6 MOON WATCH with the students.**

   Ask such questions as these:
   - How many days did we find between two full moons?
     ✔ Introduce the idea that this is a *moon cycle* or changes in the moon that happen between full moons.
   - What did the moon look like during the moon cycle?
   - When is the best time to watch the moon?
   - Did you ever see the moon during the day?
   - What does a *new moon* look like?
   - What does a new baby look like compared to you or an adult?
     ✔ Get at size.
   - Was there a time when the moon was very small? What did it look like?
     ✔ Identify this as the time of the new moon.

2. **Discuss the questions, *Do you think the number the days from one new moon to the next new moon will be different from the count of days from full moon to full moon?* and *What are the moon's shapes or phases over this cycle?***

   Help the students do the following:
   - Predict the number of days from one new moon to the next. Record their predictions on Student Page K.2.7A NEW MOON.
   - Describe and discuss the various shapes (phases) the moon had in their last study.
   - Tell what they think the moon phases will look like when they study them again.

3. **Again ask the families to help their children observe the moon whenever possible. See the sample letter in Fig. K.2.6.**

   - Send a note to families explaining the continuing assignment. Include Student Pages K.2.7A NEW MOON and K.2.7E MOON PHASES .

- Beginning with a new moon, have the students identify the moon phases, count the days until the next new moon, and record the phases in pictures.
  ✔ Use Student Page K.2.7A to record their observations.

4. **Have the students report and record their data on the Learning Calendar.**

Help them
- Draw the moon phases on the Learning Calendar.
  ✔ Ask, What was the shape of the moon?
- Name the phases as specific shapes are identified by the students.
  ✔ See the Student Page K.2.7E MOON PHASES for names.
  ✔ The concepts of waxing and waning will be introduced in *DASH* 1.
- Mark the starting *new moon* or the *beginning* of a cycle.
- Draw the moon phase for each day they see the moon.
- Mark the next *new moon* or the *ending* of the cycle.
- Count the days between new moons.
- Record the count on their calendar.

5. **Discuss the results of the moon watch with the class.**

Ask such questions as these:
- How many days are in a moon cycle starting with the new moon?
- How many days are there from the new moon to the full moon?
  ✔ There will be about 14 (13–15).
- How many days are there from the full moon to the new moon?
  ✔ There will be about 14 (13–15).
- What are the moon phases in the order you saw them?
- How are the moon phases alike? How are they different?
- How many days were there in the cycle we observed from full moon to full moon?

✔ There were between 28 and 31 days, depending on the interpretation of "new moon." The astronomical time is about 29 1/2 days.

- How are the full-moon-to-full-moon and the new-moon-to-new-moon cycles alike?
  ✔ Their counts should be about the same.

- How are they different?
  ✔ Get at the idea that they have different starting points in the same cycle.

6. **Have the students work in groups to cut out the set of large moon phases from Student Pages K.2.7B and K.2.7C SEQUENCE CARDS and put them in order.**

- Some students may arrange the cards in a linear sequence while others may form a circular sequence.

- Have them share and explain their sequences.
  ✔ Encourage the students to make any modifications they wish.

7. **Help the students organize to make a moon clock. Have them cut out the set of small moon phase pictures from Student Page K.2.7D MOON CLOCK.**

- Ask the students where they would place or draw the new and full moon cutouts on their paper plate.
  ✔ Note that the period between a new moon and a full moon is half a cycle, so they would place the new moon across from the full moon on the plate.

- Help the students lay the rest of the moon phase cutouts in order on the clock face.
  ✔ Ask them where the quarter moons go, where the crescent moons go, and finally where the gibbous moons go.
  ✔ Use the sequence cards for reference.

8. **Help the students make the clock.**

Help the students do the following:

- Make a clock by drawing or gluing their set of cutouts onto the plate.

- Cut index cards into strips to make pointers.

- Cut a point at one end of a strip and punch a hole in the opposite end with a punch or nail.
- Mark the centers of their paper plates and make holes through the center of the plate.
  ✔ You may want to punch the hole in the plate.
- Attach the pointer to the clock face with a brass fastener.

9. **Have the students test to see whether their clocks are accurate. Save several moon clocks for Activity K.2.9 CLOCKS AND CALENDARS.**

Help them do the following:

- Direct the pointer to the current moon phase.
- Move the pointer to show the next phase. If their clocks are accurate, the pointer will move in the same order as the moon phases appear.
- Re-do the clock if necessary to correspond to their observations.
- Look at subsequent moon cycles as a way of validating their data.

EXTENSIONS

- Read Frank Asch's *Happy Birthday Moon.*
- Celebrate the moon's birthday. Point out that the new moon is the beginning of another cycle and another birthday. Have the students join in the planning.
- Have the students make a large class moon clock.

SAMPLE LETTER

Dear Family:

Our kindergarten class is again observing the moon. This time we will start with the new moon, which will appear in the sky about______________________.

Enclosed is another moon observation sheet. In addition to investigating the length of the moon cycle starting from different phase, this time we will be paying closer attention to the shape and sequence of the phases. Please help your child to make the drawings. We will also be giving names to the different phases. An information sheet is attached for your reference.

Again there may be times when cloud cover will make observation impossible. Have your child invent a way to show times when no observation was made. The moon will usually be visible in either the early evening or early morning.

Thanks for your help. Please send the observation sheet back to school after the moon watch is completed. Have fun observing with your child.

Fig. K.2.7 Moon Phase sample letter

DASH

NEW MOON
SP K.2.7A

Name ______________________

Date ______________________

Prediction	**Observation**
I think it will be _____ days until the next **new** moon	I counted _____ days from one **new** moon to the next.

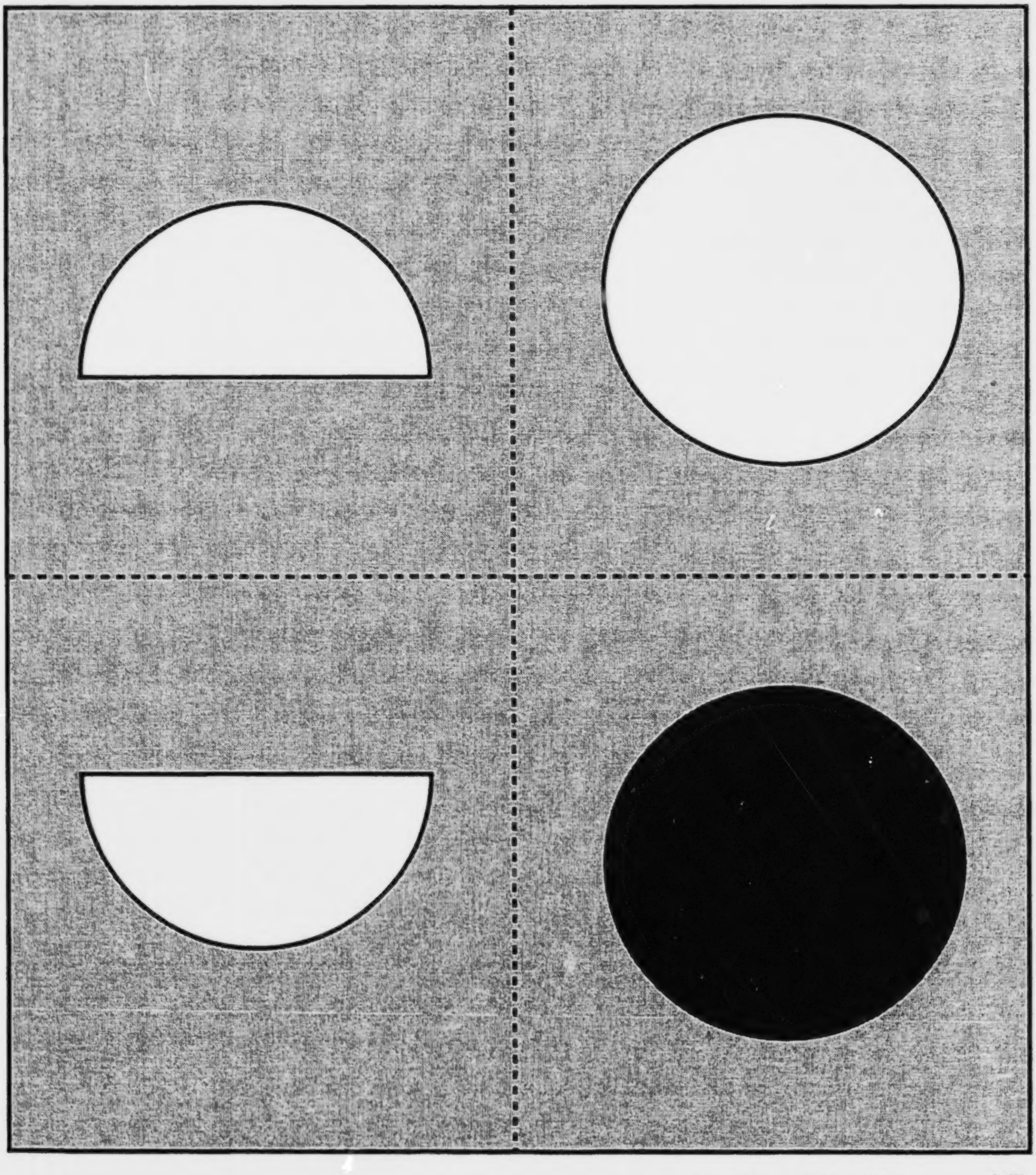
new ●	○	○	○	○	○	○
○	○	○	○	○	○	○
○	○	○	○	○	○	○
○	○	○	○	○	○	○
○	○	○	○	○	○	○

DASH

SEQUENCE
CARDS
SP K.2.7B

Name ____________________

Date ____________________



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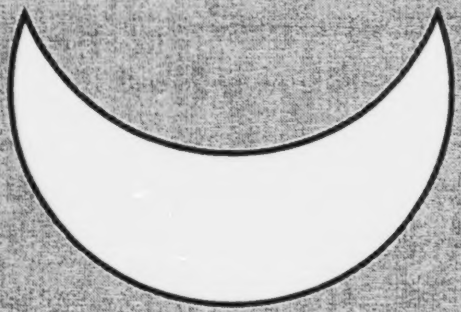
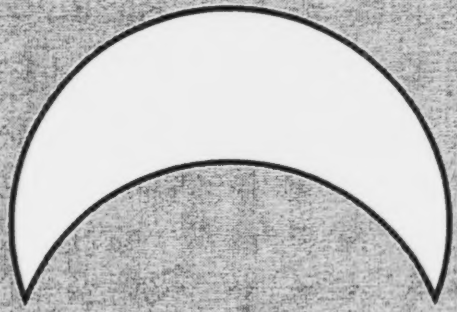
DASH

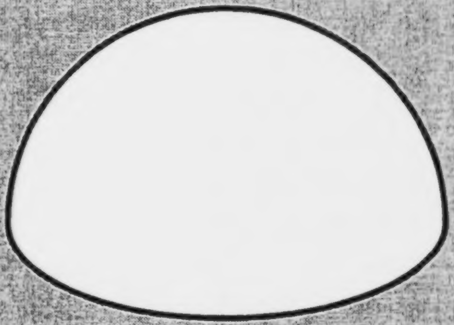
SEQUENCE
CARDS
SP K.2.7C

Name ____________________

Date ____________________



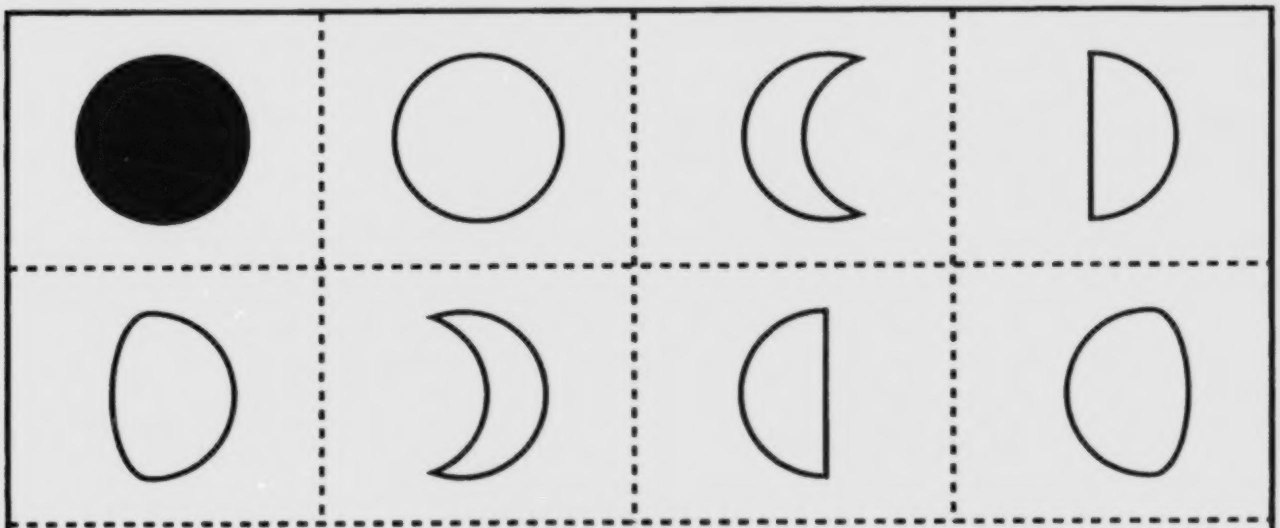




MOON CLOCK
SP K.2.7D

Name ______________________

Date ______________________

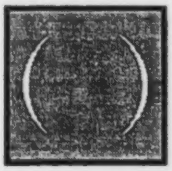


DASH

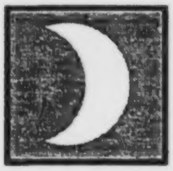
MOON PHASES
SP K.2.7E

Name ____________________

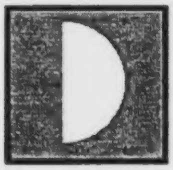
Date ____________________



NEW: darkened or very dimly lit.

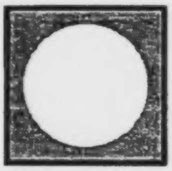


CRESCENT: smaller than half of the moon's face.



QUARTER: half of the moon's face is visible.

GIBBOUS: appears larger than a quarter moon yet is not full.



FULL: entire face of the moon is seen.

1.2.12 MOONRISE AND MOONSET

OBJECTIVES

The students
- Observe the moon rising in the east.
- Observe the moon setting in the west.
- Learn a mnemonic about moonrise and moonset.
- Develop a sense of using the moon to identify compass directions.
- Observe and record times of moonrise and moonset.
- Observe that the moon appears to wax and wane.
- Use newspaper, internet, or almanac information to record moonrises and moonsets on the class calendar.

BACKGROUND

In this activity students observe and note the compass direction of where the moon appears to rise and set. If students are new to DASH you may need to review the moon phases. See Kindergarten DASH Activities K.2.6 MOON WATCH and K.2.7 MOON PHASES.

Introduce this activity after the students are well practiced in recording and graphing the time of sunrise and sunset. See ACTIVITY 1.2.8 SUNRISE AND SUNSET. After observing the moon, the students can get data each day from newspapers, the internet, tide or fishing calendars, or almanacs to record moonrise and moonset on the Learning Calendar.

The purpose of this activity is to observe the moon cycle, noting the regularity of the phases and to observe that the moon waxes or grows as it moves from new moon phase to full moon, and wanes or shrinks as it goes from full moon to new moon. It is sufficient in DASH 1 if students begin to realize that the moon appears to rise in the east and set in the west, and that it rises later day by day. In DASH 2 the recurring pattern of moonrises and moonsets will be observed when the students graph this data. Explanation of how the moon cycle operates doesn't occur until DASH 4 after four years of observation.

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STUDENT ROLES

Astronomer
Mathematician

MATERIALS

Learning Calendar
newspaper, the internet, calendar, or almanac data on moonrise and moonset
Wonder and Discover Book
Working Dictionary
Student Page 2.2.4 MOONRISE AND MOONSET

PRODUCTS

Concept map about the moon
Learning Calendar data
Working Definition of moon cycle
Completed Student Pages

PROCEDURES

1. **Set the stage for moon study by making a concept maps about what the students know about the moon and its cycle.**

   Include such questions as these:
   - What are the moon's phases?
   - In what sequence do the moon phases take place?
   - What seems to happen to the moon as it moves through its phases?
     ✔ Work for the idea that it seems to change its size—to grow and shrink.
     ✔ Introduce the terms *waxing* and *waning*.
   - About how long does one moon cycle take?
   - How might you find out where the moon rises? The moon sets?
   - What questions do you have about the moon and its cycle?

2. **Have the students observe the moon through one or more cycles recording on the Learning Calendar the phase and whether it is waxing or waning. Then return to the concept map about the moon and add or revise information.**

3. **Have the students observe the moon rise during school time.**

   Include such questions as these:
   - Where did you look to find the rising moon?
   - If you were looking for the next moon to rise, what part of the moon might you see first?
   - What phase was the moon in when you saw it rising?
   - When do you think the moon will rise tomorrow? How could you find out?

4. **Have the students observe the moon set during school time. Use Student Page 1.2.12 at home to verify the directions of moonrise and moonset.**

   Include such questions as these:
   - Where did you look to find the setting moon?
   - If you were looking for the next moon to set, what part of the moon might you see last?
   - What phase was the moon in when you saw it setting?
   - When do you think the moon will set tomorrow? How could you find out?
     ✔ Work for the idea of looking for the time in the newspaper or other data source.
     ✔ Add the recording of moonrise and moonset to the Learning Calendar and Responsibility Chart.
   - Does the moon rise at the same time as the sun? Set at the same time?
     ✔ This is a question for the Wonder and Discover Book.
   - Is the moon in the sky as long as the sun is in the sky?
     ✔ This is another question for the Wonder and Discover Book.
   - Do you have any other questions about the moon and its phases?

5. **Introduce a new verse to the Body Compass Song that uses the moon to find direction. Add *moonrise* and *moonset* to the compass directions posted in the classroom. See Activity 1.7.2 NORTH, SOUTH, EAST, AND WEST.**

   Sing to the tune of *Johnny Comes Marching Home*
   The moon is rising in the east, the east, the east.
   The moon is setting in the west, the west, the west.
   My nose is north.
   My seat is south.
   The earth can turn itself about.
   The moon is rising in the east
   And setting in the west.

6. **Have the students summarize their moon study by returning to the class concept map about the moon to record new information and revise as necessary and by creating or revising their Working Definition of the moon cycle. Record any remaining questions in the Wonder and Discover Book for investigation in DASH 3.**

EXTENSION

- Have the students make timelines for two or more moon cycles on adding machine tape recording the date, the moon phase including waxing or waning, and the time for moonrise and moon set. Have them lay the timelines out, one above the other, and look for similarities and differences.

DASH

MOONRISE AND MOONSET
SP 1.2.12

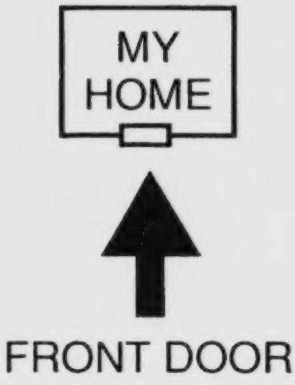
Name: ______________________

Date: ______________________

Label the directions at your home using N, S, E and W.

Draw a crescent moon to show where the moon RISES at your home. In which direction does the moon rise? ______________________

Draw a full moon to show where the moon SETS at your home. In which direction does the moon set? ______________________



1.2.6 TIME LINE

OBJECTIVES

The students
- Observe that there are 24 hours in a day.
- Observe that there are 60 minutes in an hour.
- Create a 24-hour time line.
- Identify AM and PM on their time line.

BACKGROUND

This is the third activity on digital time. Students move from the familiar wristwatch or clock time to a linear model (a time line) that parallels the Learning Calendar. The time line provides a tool to think of how the minute and hours of the day follow each other.

Each student makes a 24-hour digital time line. This is used to determine the interval between events such as sunrise and sunset, school opening and closing, etc. For example, to find the interval between going to sleep and waking up, the hours and minutes may be counted or measured. To measure use three time lines. Put two time lines end to end. Mark the times of going to sleep and waking-up. Put the third time line next to the other two with midnight at the going-to-sleep time. Use this third time line as a number line and read the number of hours and minutes slept directly from the third time line at the waking-up time.

If several intervals of time are to be added (as in time spent eating), begin the second interval (lunch) at the ending point of the first interval (breakfast) on the third time line. Continue until all intervals are added together. This is a beginning addition slide rule.

STUDENT ROLE

Chronologer

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MATERIALS

student digital clocks from Activity 1.2.4 THE DIGITAL CLOCK
scissors
glue

Student Page	1.2.6A	TIME LINE (one copy per student)
	1.2.6B	TIME LINE (3 copies per student)
	1.2.6C	WHAT TIME IS IT? (one copy per student)
	1.2.6D-H	HOURS AND MINUTES (one copy per student)

PRODUCTS

A 24-hour digital time line
Completed Student Pages

PROCEDURES

1. **Review and discuss the digital time with the class.**

   Ask such questions as these:
   - What was the first hour of today?
   - When did that hour occur?
   - What will be the last hour of today?
   - When will that hour occur?
     ✔ Students might set an alarm clock at home to test their answer. If students are to do this, break the inquiry here and wait until they have had time to make their observations.
   - Can you set your digital clock to show the largest possible number of minutes after the hour of 12:00?
   - How many minutes did you find?
   - What is the largest possible number of minutes after 1:00, 2:00, any hour?

2. **Introduce the time line to the class.**

   State that we need to have a way of seeing time for the whole day. Show students a 12-hour time line.

- Have a student number the time line at one-hour intervals from 12:00 to 12:00.

- Ask whether anyone knows another name for 12:00.

- Identify one 12:00 as midnight and one as noon.

3. **Help students discover a full-day time line.**

Ask such questions as these:
- How many hours are in one full day?

- Does this time line represent a full day?
  ✔ 24 hours?

- What would we have to do to make it a full-day time line?

- Can you make a full-day time line?
  ✔ Have students invent a way; assist only as needed.

- What does the time line look like?
  ✔ Correct errors in the sharing process.

- Can you number the hours on this time line?

4. **Have students construct their own digital time lines.**

Each student will need 1 copy of Student Page 1.2.6A TIME LINE and 3 copies of Student Page 1.2.6B TIME LINE.

Have students
- Cut out all 8 time line pieces.

- Put glue on the word "glue."

- Put strips together. The first strip has a space for the student's name.

- Have students label their 24-hour time lines from 12:00 midnight to 12:00 midnight.

5. **Introduce the minute position.**

Ask such questions as these:
- What is the number of minute spaces between 12:00 and 1:00 on the time line?

✓ If students are careful, they will count 60 spaces.

- What is the largest number of minutes your digital clock will show between hours?
  ✓ Between 12:00 and 1:00, students will show 59.

- There is one that you did not count. Can anyone find it?
  ✓ If necessary, show that it is the minute that ends at 1:00. This will be a difficult concept for many students to intellectualize at this point. Do not be concerned. The idea will come up many times. The major point is that there are 60 minutes in an hour.

- How many minutes are there in an hour?

- Can you number the minutes on your time lines by tens from 12:00 to 1:00?
  ✓ 10, 20, 30, 40, 50.

- What does your time line look like now?

- Where is the 60th minute?

- How many minutes in a half hour?

- Can you mark the thirty-minute points on the rest of your time line?

- What does your time line look like now?

6. Introduce AM and PM

Ask such questions as these:

- Where is the morning side of our time line?

- Does anyone know what else people call the morning hours?
  ✓ Give the term "AM," meaning ante meridian or before noon.

- Can you run an apricot line along the AM part of your time line?

- Where is the afternoon and evening side of your time line?

- Does anyone know what else people call the afternoon and evening hours?
  ✓ Give the term "PM," meaning post meridian or afternoon.

- Can you run a purple line along the afternoon and evening side?

7. **Have students use Student Page 1.2.6C WHAT TIME IS IT? to keep track of a school day.**

   - Have students draw (and label) pictures and/or keep a similar record on chart paper to assist with spelling as needed.

   - Cut the worksheet into strips and have students use paper clips to attach each activity at the appropriate time on their time lines.

   - Have student teams check each other.

8. **Have students complete Student Pages 1.2.6D-H HOURS AND MINUTES to keep track of a 24 hour day. Students will need to take these pages home to complete them.**

9. **Have student groups invent a way to determine the hours and minutes between events using their time lines.**

   Some suggested questions are
   - How could you use your time lines to show the number of hours and minutes you slept last night?

   - How long were you in school yesterday?

   - How much time did you spend eating yesterday?

DASH

TIME LINE
1.2.6A

Name: ____________________

Date: ____________________

NAME:

GLUE

DASH

TIME LINE
1.2.6B

Name: ______________________

Date: ______________________

GLUE

GLUE

SP 1.2.6C

DASH

WHAT TIME IS IT? 1.2.6C

Name: ____________________

Date: ____________________

What time is it?	What am I doing?

DASH

HOURS AND MINUTES 1.2.6D

Name: ____________________

Date: ____________________

What time is it?	What am I doing?
8:00 am	
8:30 am	
9:00 am	
9:30 am	
10:00 am	
10:30 am	
11:00 am	
11:30 am	
12:00 noon	
12:30 pm	

DASH

HOURS AND MINUTES 1.2.6E

Name: ____________________

Date: ____________________

What time is it?	What am I doing?
1:00 pm	
1:30 pm	
2:00 pm	
2:30 pm	
3:00 pm	
3:30 pm	
4:00 pm	
4:30 pm	
5:00 pm	
5:30 pm	

DASH

HOURS AND MINUTES 1.2.6F

Name: ______________________

Date: ______________________

What time is it?	What am I doing?
6:00 pm	
6:30 pm	
7:00 pm	
7:30 pm	
8:00 pm	
8:30 pm	
9:00 pm	
9:30 pm	
10:00 pm	
10:30 pm	

DASH

HOURS AND MINUTES 1.2.6G

Name: ____________________

Date: ____________________

What time is it?	What am I doing?
11:00 pm	
11:30 pm	
12:00 am	
12:30 am	
1:00 am	
1:30 am	
2:00 am	
2:30 am	
3:00 am	
3:30 am	

DASH

HOURS AND MINUTES 1.2.6H

Name: ____________________

Date: ____________________

What time is it?	What am I doing?
4:00 am	
4:30 am	
5:00 am	
5:30 am	
6:00 am	
6:30 am	
7:00 am	
7:30 am	
8:00 am	

1.2.8 NIGHT AND DAY

OBJECTIVES

The students
- Collect data about sunlight and seasonal change.
- Observe that the length of one day-and-night cycle is about 24 hours.
- Correlate changing length of day with seasonal changes.
- Correlate day and night length with solstices and equinoxes.
- Practice using digital time.

BACKGROUND

This year-long activity should be started about 2 weeks after sunrise and sunset data collection becomes routine. Students convert the data from Activity 1.2.7 SUNRISE AND SUNSET into linear representations of time with string or tape. The string or tape can be colored with marking pens, crayons, or even chalk.

During the year a series of correlations are made as students work toward an understanding of seasons.

STUDENT ROLE

Astronomer

MATERIALS

class chart day and night
tape or string
yellow and black crayons, markers, or chalk
stapler
time line from Activity 1.2.6 TIME LINE
scissors
glue
Student Pages 1.2.8A CLASS TIME LINE
1.2.8B DAY AND NIGHT IN SUMMER

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PRODUCTS

Class chart day and night
Class time line
Completed Student Pages

PROCEDURES

1. **Establish the need for the class chart day and night.**

   Have the students construct a month-by-month time line for the chart using Student Page 1.2.8 CLASS TIME LINE.

   Ask such questions as these:
   - What seems to have happened to the length of the day since we have started keeping records?

   - How can we tell?

2. **Demonstrate using the digital time line from Activity 1.2.6 TIME LINE to represent the daylight hours between sunrise and sunset. See Figure 1.2.8.**

   - Cut a piece of tape or string as long as the 24-hour time line.

   - Place the tape along side the time line.

   - Mark the times of sunrise and sunset on the tape.

   - Color the tape yellow between sunrise and sunset.
     ✔ Day.

   - Color the remainder of the tape black.
     ✔ Night.

   - Attach the tape to the chart under the appropriate date on the class time line.

   Have each group make one or more representations of daylight length for previously collected sunrise and sunset data.

   A new tape should be added to the class chart at least once each week.

3. **Discuss correlation 1, days get shorter and nights get longer in fall.**

   Explore the length of night and day after a month.

   Ask such questions as these:
   - How long is the night?
   - How long is the day?
   - What is happening to the length of the day and night?

4. **Discuss correlation 2, the length of day plus the length of night are equal to about 24 hours.**

   Ask such questions as these:
   - How long a time is it from sunrise to sunrise?
   - How can we find out?
     ✔ There are several ways: (a) Measure directly on the time line. Put 2 time lines together using one as a time ruler. (b) Put night and day tapes end to end and measure on the time line. (c) Calculate.

5. **Discuss correlation 3, the lengths of day and night are the same on September 23, the first day of fall.**

   - Around the middle of September have students find out the date of the first day of fall.
   - Have students predict what might happen to the length of day and night on that date.
   - After the date have students make correlations between the equinox and the first day of fall.

6. **Have students record their predictions about what will happen next to the length of day and night on the Learning Calendar.**

   - Watch to see whether their predictions are correct.
   - Have students continue to make predictions after each discussion.

7. **Discuss correlation 4, December 22, the first day of winter, has the longest night and the shortest day.**

   - Two weeks before Christmas vacation, ask students to find out when the first day of winter will be.
     ✔ Suggest that they may use the radio, TV, newspaper, their parents, etc., as information sources.

   - Continue sunrise and sunset data collection over the vacation.

   - On return from vacation, correlate day and night length with the first day of winter.

8. **Discuss correlation 5, days get longer and nights shorter as the winter progresses.**

   Begin any time after the students return from Christmas vacation.

   Ask such questions as these:
   - What seems to be happening to the length of the day?

   - When did this seem to start?

   - How long do you think this will go on?

9. **Discuss correlation 6, the lengths of day and night are the same on March 21, the first day of spring.**

   - Around the beginning of March ask students to find out when the first day of spring will be.

   - Ask students to predict what will happen to the length of day and night on that day.

   - After the event make correlations between the equinox and the first day of spring.

10. **Discuss correlation 7, days continue to get longer and the nights shorter in the Spring.**

    A week or so after the Spring Equinox ask such questions as these:
    - What is happening to the length of the day?

    - How long do you think this will go on?

- Can you predict when there might be a change?

11. **Right before summer vacation, challenge students to find out if and when the days start to get shorter again over the summer.**

    Use Student Page 1.2.8B DAY AND NIGHT IN SUMMER to record data.

EXTENSIONS

- Have students make a day-and-night graph for shorter time intervals. Have them graph data every day or every other day.
- Have students record the total time from sunrise to sunrise on the Learning Calendar. Students may notice the times are a bit longer than 24 hours for some seasons and shorter for others.

ILLUSTRATION

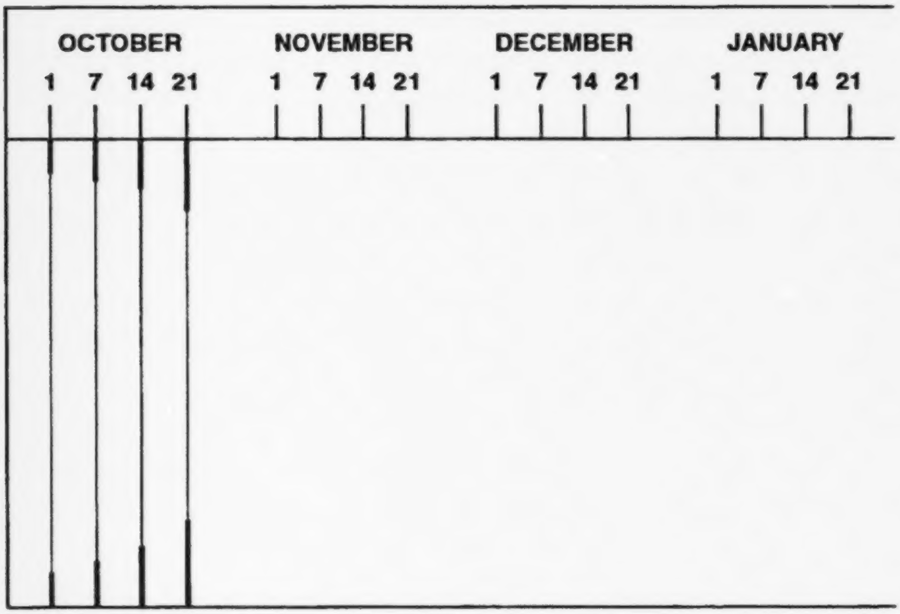


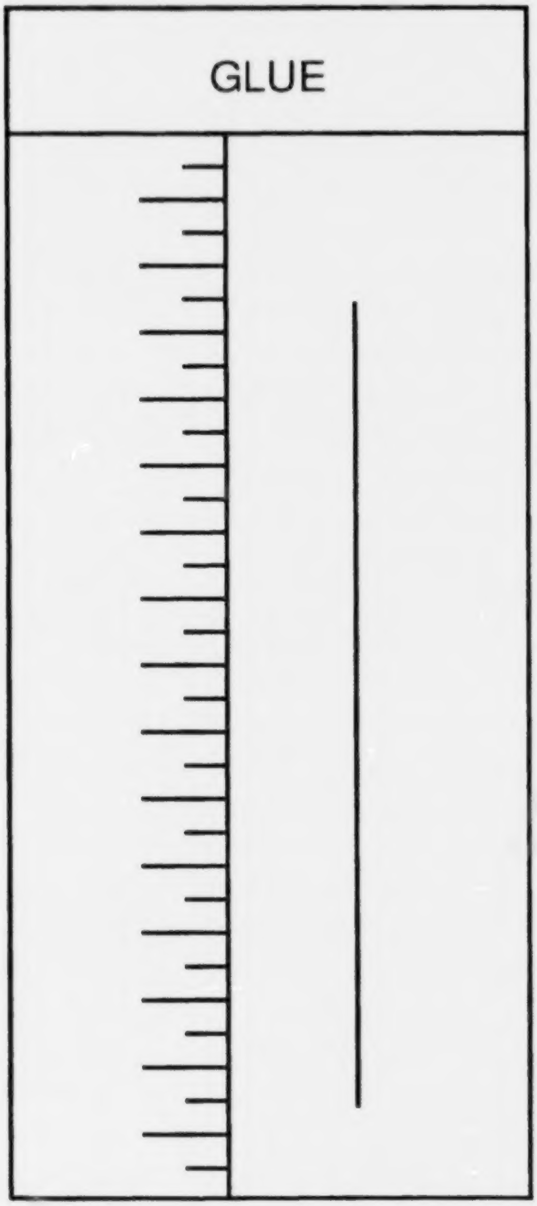
FIGURE 1.2.8 Night and Day

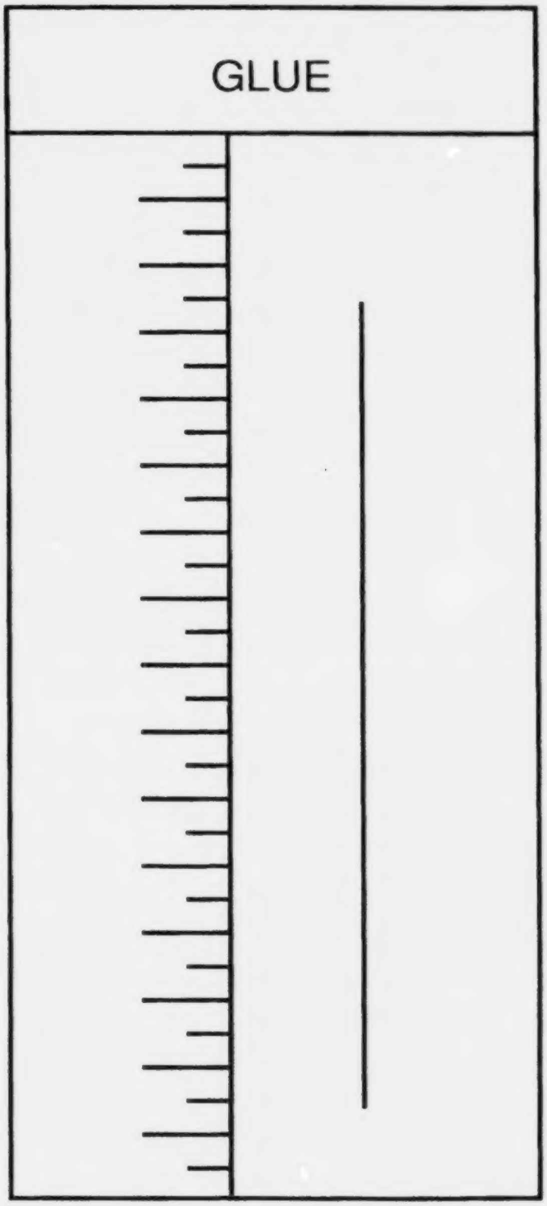
DASH

CLASS TIME LINE 1.2.8A

Name: ____________________

Date: ____________________





Cut one strip for each month. Each one-half centimeter is equal to one day. Cut off excess for months with fewer days. Label months. Glue strips together. Begin with current month.

DASH

DAY AND NIGHT IN SUMMER
1.2.8B

Name: ____________________

Date: ____________________

DATE	SUNRISE	SUNSET	OBSERVATIONS

1.8.1 TEMPERATURE OF THINGS

OBJECTIVES

The students
- Discover that temperature is a major variable in the environment.
- Discover that there is a comfort range for temperature.
- Associate temperature differences with seasons, shadow, and light.
- Discover that it takes different kinds of thermometers to measure different ranges of temperature.
- Create a working definition for temperature.

BACKGROUND

This is a long-term activity that begins with the collection of temperature data which are recorded on the class calendar. After completing Activity 1.2.9 THE SUN students should be encouraged to take and record temperatures whenever they find a place or a thing with unknown temperature conditions.

This activity will require several different kinds of thermometers:
- Narrow-range thermometers to measure the body temperature of humans and animals.
- Wide-range environmental thermometers.
- High-range cooking thermometers.

Groups of 2–4 students are assigned to each category of measurements. Assign a group when a new kind of measurement is needed. Individuals may also want to have their own temperature-measuring projects.

Group assignments can include finding temperatures of well and sick people, outside still air, outside moving air, room temperatures, cooking temperatures, outside precipitation, outside soil temperature, etc.

Problems concerning Fahrenheit and Celsius can be solved by using thermometers with both scales side by side. Otherwise, the conversion formulas are

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$$T_C = 5/9\ (T_F - 32°)$$
$$T_F = 9/5 T_C + 32°$$

Temperatures of people can be taken under the arm, orally if disposable sleeves are used, or on the skin using a liquid crystal thermometer.

Problems concerning temperatures below zero should not be intellectualized at this time. A temperature below zero should be treated as just another point on the scale. We simply count both ways from zero. We are laying the groundwork for a wide variety of quantitative scales that involve a zero point, for example, dates (BC–AD), bank balances, etc.

CAUTION: A permission system should be established for measuring high- and low-range temperatures. Parental help may be used.

STUDENT ROLE

Scientist

MATERIALS

The Learning Calendar
1–4 thermometers –10° to 110°C
1–4 oral-range thermometers
1–2 high-range oven thermometers
chart paper
markers
Student Page 1.8.1 TEMPERATURE OF THINGS

PRODUCT

Completed Student Pages

PROCEDURES

1. **Review the care, the holding, and reading of a thermometer when The Learning Calendar is started.**

   Some suggested questions are
   - What temperature information did you keep last year?
   - What did you learn about temperature?

- Did temperature change from day to day?

- How did you measure temperature?

- Where did you take temperatures?

2. **Suggest to students that we want to find out all we can about the temperatures of things.**

   Begin with the calendar and record temperature changes during the day.

   Ask such questions as these:
   - Where should we take temperatures and why?

   - When should we take temperatures?

3. **After Activity 1.2.9 THE SUN, have students begin taking other kinds of temperatures and record their data on Student Page 1.8.1 TEMPERATURE OF THINGS or a class chart.**

   Ask such questions as these:
   - Are there other things you would like to know about temperature changes?

   - What kind of records should we keep? Standardize a report form (date, time, conditions, name of reporter, etc.).

4. **Assign a temperature team whenever a new temperature-measuring event occurs.**

5. **Have students create a working definition of temperature about mid-year and record it in the Working Dictionary.**

   Some examples of working definitions include the following:
   - Temperature is a measure of how hot or cold something is.

   - Temperature is what we measure on a thermometer.

SP 1.8.1

DASH

TEMPERATURES OF THINGS
1.8.1

Name: ______________________

Date: ______________________

WHO?						
°F						
°C						
WHERE?						
TIME						
DATE						

DASH

K.3.8 HOW BUGS WALK

OBJECTIVES

The students
- are introduced to external bug body parts and their functions
- compare insects, spiders, isopods, centipedes, and millipedes by their leg counts
- use simulations to help predict ways they will find that bugs can walk

---

BACKGROUND

HOW BUGS WALK is one of four activities on external anatomy. It is followed by K.3.9 PARTS OF BUGS. Others activities in the series are K.3.10 PARTS OF MAMMALS and K.3.11 PEOPLE.

Predicting leg motion

This activity is designed to introduce the body structure of insects and their relatives. Using simulations, the students can make predictions about the ways bugs walk. In K.3.9 PARTS OF BUGS, these predictions will be tested. Through the simulation they will begin to get a sense of the segmented nature of bugs.

Bugs as a category

Bugs is a convenient, collective, and common name for the organisms introduced here. It represents the major division of the animal kingdom called Arthropoda, which includes the animals studied in the activity—insects, spiders, crustaceans, centipedes, and millipedes.

There is a technical problem in using the common name "bugs" because one of the orders or subdivisions of insects is "bugs," sometimes called "true bugs." This order includes the lace bug, stink bug, and the water boatman. This complication is not ignored in *DASH*; it is simply not fully explored in kindergarten. It is the intent of *DASH* to introduce both common and technical words because the students live with both common and technical names.

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Biology of the rhyme
Arthropods include six living classes. The most common five are referred to in the rhyme. See Fig. K.3.8. All arthropods have segmented bodies of more or less distinct parts. These parts are covered by an exoskeleton much like jointed pieces of armor. The exoskeleton is a tough, thin shell, and the muscles that move it are attached on the inside of the shell. This arrangement is quite different from our bodies where the skeleton is on the inside and the muscles are outside the skeleton.

The common five classes have different numbers of *walking legs*, and this feature is captured in the rhyme.

- *Insecta* or *insects* have 6 legs. They include beetles, butterflies, moths, and ants.
- *Arachnids* have 8 legs. They include spiders, horseshoe crabs, scorpions, and ticks.
- *Crustaceans* have 10 to 20 legs. They include crayfish, lobsters, barnacles, and isopods such as pill bugs (sow or roly-poly bugs).
- *Chilopods* or *centipedes* have 48–60 legs.
- *Diplods* or *millipedes* have 80–400 legs.

All these arthropods have mouth parts, some for crushing, some for sucking. All have eyes, and all but the spiders have antennas.

Use of the rhyme
Have fun with the rhyme. It provides the information base to support the simulation of bugs walking. By linking bodies, the students get a sense of the segmented nature of the bugs. Rhyme, rap, music, chant, and body motion all enhance memory.

STUDENT ROLES

Entomologist
Dancer

MATERIALS

chart paper
markers
sticks or cardboard tubes
We Are Bugs rhyme

PRODUCTS

Bug walks
Chart about the ways bugs walk

PROCEDURES

1. **Ask the students questions about their experiences with bugs.**

   Ask such questions as these:
   - Where have you found bugs?
   - What does a bug look like?
   - Are all bugs alike?

2 **Read the rhyme *We Are Bugs***

3. **Discuss the rhyme and have the students demonstrate the body parts.**

   Ask such questions as these:
   - What are bugs?
   - How might we tell an insect from a spider? From a crustacean? From a centipede? From a millipede?
   - What do insects have on their heads?
   - What might the antennas be used for?
   - Do you know of another kind of antenna?
   - How might a TV antenna be like the bug's antenna?
   - What might a bug use its eyes for?
   - What might a bug use its mouth for?
   - What kinds of sounds do bugs make?
   - How do bugs get around from place to place?

4. **Read the rhyme again and explore the way insects might walk.**
    - Help student groups of three form an insect with six legs.
    - The first person uses his or her arms as antennas.
    - The second person wraps his or her arms around the waist of the first person and provides the second pair of legs.
    - The third person does the same for the third pair of legs.
    - Have the groups experiment in their insect groups with ways of walking.

- Have the groups demonstrate how insects might walk.

5. **Continue the exploration with the walking problems of other bugs.**
    - For spiders, add one person to the previous insect group. ✔ Spiders will not have antennas, a piece of information you will probably have to provide.
    - For a crustacean such as a crayfish, go to 5 students. ✔ Crayfish have antennas as do the rest of the arthropods.
    - For an isopod such as a pill bug (sow bug or roly-poly) with 14 legs, 7 students will be needed. ✔ Bring out the idea that we are adding segments to which the legs are attached.
    - For a centipede, use the whole class. Though "centipede" indicates something that has 100 legs, most centipedes have only 48–60 legs. Each additional person is another segment in the body,
    - For a millipede, have each student be one body segment with two pairs of legs. Arms can be extended to the floor with sticks or cardboard tubes to act as another pair of legs.

6. **Raise some further questions for investigation.**

   Ask such questions as these:
   - How do you think real insects, spiders, centipedes, and millipedes walk?
   - How could you find out?

7. **Make a two-column chart, one for predictions and one for observations about the way different kinds of bugs walk. Use such descriptions as *all move together*—all legs going forward and backward at the same time; *opposite sides move together*—legs on one side going forward while legs on the other go backward; *legs not moving together*. Proceed to Activity K.3.9 PARTS OF BUGS where bug walking is observed.**

EXTENSIONS

- Have the student simulate the walk of two- and four-legged animals .

WE ARE BUGS

Refrain
We are bugs, bugs, walking up and down again.
Bugs, bugs, flying all around again.
Bugs, bugs, digging in the ground again.
Bugs, bugs, listen to our sound again.

Stanza
"Bugs" is the name we are commonly called,
A name that leaves entomologists galled.
Arthropods they claim
Is really our name,
So we'll learn both and they won't be appalled.
Refrain

Stanza
Our bodies are shells, segmented and firm,
Though some larvae are soft, just like a worm.
We have lots of legs,
And we all lay eggs,
And many of us live for a very short term.
Refrain

Stanza
We are known by the walking legs we inherit.
Insects have six, that's all that they merit.
Spiders have eight.
Now the number gets great
As a crustacean needs 10 to 20 to bear it.
Refrain

Stanza
Next comes the very fierce centipede.
Its name is most impressive indeed.
But it really does cheat,
And has not a hundred feet.
Only some 50 or 60 it really does need.
Refrain

Stanza
Now the leg count gets even bigger still,
For a thousand is the meaning of "mill."
And the long millipede
Walks quickly indeed
On 80 to 400 with coordinated skill.
Refrain

Stanza
Antennas can stick out of our head,
And our eyes may be white, green, or red.
Some mouths are like straws,
Some great crunching jaws,
Food odors we must sense in order to be fed.
Refrain

Stanza
There are very few things that we won't eat,
Be it vegetables, fruit, paper, or meat.
We clean up your mess,
Without us we'd guess
Decomposition would never be complete.
Refrain

Fig. K.3.8 Bug rhyme

K.3.9 PARTS OF BUGS

OBJECTIVES

The students
- identify external bug body parts and their functions
- observe how different kinds of bugs walk

BACKGROUND

PARTS OF BUGS is one of a series of activities on external anatomy. It should follow Activity K.3.8 HOW BUGS WALK and precede K.3.10 PARTS OF MAMMALS and K.3.11 PEOPLE.

The students pursue the question, *What are the external body parts of bugs?* To do this, they go into the field and observe bugs where they live. This is also a time to look further into how bugs walk.

Parts of bugs

The students were introduced to five different kinds of bugs or arthropods and some of their characteristics in Activity K.3.8 HOW BUGS WALK. In that activity, the students simulated the walking of insects, which have 6 legs; spiders, 8; crustaceans, 10–20, centipedes, 50-60; and millipedes, 80–400. They have felt the movement of segmented bodies made of jointed parts that allow arthropods to bend. They have heard that all bugs have eyes, and all but spiders, antennas.

Possible observations

Identification of body parts and other observations that may be made about various bugs are listed below:

- Insects have three big body divisions seen as separate bulges—the *head*, the *thorax*, and the *abdomen*, the same divisions we have in our body. The abdomen and thorax of insects consist of several segments. Six legs are attached to the thorax. Insects may also have wings.

- Spiders and their relatives have two big body divisions seen as separate bulges—the *cephlothorax*, a fused head and thorax, and an *abdomen*, and 8 legs. Scorpions are members of the same group as spiders and have eight legs and two pincers and a segmented abdomen with a poison tip.

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- Crustaceans have two big body divisions seen as separate bulges—the *cephlothorax*, a fused head and thorax, and an *abdomen*. The abdomen is often divided into many segments, for example in the isopod called a pill bug. Leg counts can run from 10–20. Many water-dwelling members such as the crayfish and lobster have claws.

- Centipedes and their relatives have a *head* and a single pair of legs from each of 24–30 body segments with a total leg count of 48–60.

- Millipedes and their relatives have a *head* and two pairs of legs from each of 20 to 100 body segments with a total leg count of 80–400.

Do not expect the students to find all body parts at this time. Though most students will quickly pick up new words, this is not a vocabulary lesson, and they should concentrate on the nature of the structures rather than their particular names.

Handling and housing bugs
The students *should not* handle spiders, scorpions, centipedes, or millipedes. Until they can distinguish between different bugs, have them scooped into containers. To keep organisms from escaping from a container, cover the mouth with nylon hose or plastic wrap with holes to allow air to enter. For viewing, use a clear plastic cup.

Have the students mark where all bugs they collect are found with a flag on a skewer. Return the organisms to the environment as soon as possible.

Magnifying glasses
Have the students practice with their magnifiers before they go into the field. Have them explore
- how to focus the magnifier by moving it up and down
- how close they must get their eye to the magnifier
- how different magnifiers provide different amounts of magnification

Detailed study to insects
It is suggested that the detailed study of bugs can be limited to insects though study of other bugs is encouraged. Often there will not be enough specimens to allow study of other kinds of bugs.

Bug models
Models of insects and other bugs can be made using a wide variety of recycled materials, glue, and tape. Put materials into an Inventor's Box and appeal to the imagination of the students.

STUDENT ROLES

Entomologist
Zoologist
Biologist

MATERIALS

clear plastic cups
recycled nylon stockings
skewers
small fabric or yarn streamers.
plastic wrap
tape
glue
spoons
gloves
materials for bug models:
  Styrofoam
  clay or Play Dough
  straws
  egg cartons
  small boxes
  tubes
  other as requested or brought in by students
magnifying lenses

Student Pages	K.3.9A	INSECT
	K.3.9B	BUGS

PRODUCTS

Completed class chart about ways bugs walk from Activity K.3.8 HOW BUGS WALK.
Bug models
Completed Student Pages

PROCEDURES

1. **Introduce the use of a magnifying glass or hand lens.**

Have the students do the following:
- Hold the magnifying glass close to object to be viewed.
- Slowly move the magnifying glass up toward the eye until the object comes into focus.
- Practice with various objects.
  ✔ A center where hidden things can be looked for in sand, soil, or fish gravel provides a good place to practice.

2. **Prepare for the field experience.**

- Make marker flags and temporary cages.
- Discuss field safety.
  ✔ How animals are to be observed and handled.
  ✔ What kinds of animals to tell you about.

3. **Return to the rhyme *We Are Bugs* from Activity K.3.8 HOW BUGS WALK and help the students recall how they can tell whether they have found insects, spiders, crustaceans, centipedes, or millipedes.**

4. **Have the students take hand lenses and go into the field to observe bugs.**

Have them do the following:
- Look for insects, spiders, crustaceans, centipedes, and millipedes.
- Notice the kinds of places they are found.
- Observe how each kind of bug walks.
- Return to the classroom and tell what they have found.

5. **Have the students take containers with covers and flags and return to the field to collect insects and bring them into the classroom. Have them get as *large* an insect as possible.**

Have the students do the following:
- Scoop up insects carefully and gently.
  ✔ They can usually be scooped up with the containers.

- Cover the container for viewing.

- Put a flag where an insect is collected.

6. **Have the students observe their insects as you lead a discussion.**

Ask such questions as these:

- How do you know that you have an insect?
  ✔ Get at the number of legs.
  ✔ Use a magnifying glass as necessary.

- Can anyone show us the head of your insect?

- How do you know it is the head.
  ✔ Probe for the idea that this is where you find what look like eyes, and antennas.

- Can anyone show us where your chest is?
  ✔ Ask if anyone knows another name for chest, one that doctors sometimes use. If needed, give them the name *thorax* and write it on the board.

- Insects have a thorax, where might it be?
  ✔ Work to the idea of being below or right behind the head.

- Does anyone who has insects find a bulge in the back of the head or behind it? Can you show us?
  ✔ The thorax will be quite prominent on insects such ants and those that fly and less prominent on beetles.

- Does anyone know what doctors call your tummy or belly?
  ✔ Work to the idea of an *abdomen*. Write *abdomen* on the board.
  ✔ Point out that insects have a separate abdomen.

  Does anyone find a bulge in back of or behind the thorax? Can you show us?
  ✔ The abdomen will be quite prominent on insects such as ants and those that fly and less prominent on beetles.

- Where on our insect do the legs seem to be attached?
  ✔ This will be on the thorax. However, there will be a lot of movement and this may be difficult to see.

- Does anyone see anything else on your insect.
  ✔ Get at such things as wings, mouth parts, and antennas.

7. **Have the students draw their insect on Student Page K.3.9A INSECT. Have them label the head, thorax, abdomen, wing, antenna, eye, and leg.**

8. **Have the students return their insects to the place they found them.**

   - When observations are complete, return the insects to where they were found.

   - Collect flags.

   - If there is time, other bugs can be investigated the same way.

9. **Have the students make three-dimensional models of a bug. Have them use recycled materials.**

   Help the students do the following:
   - Label the parts of their models.

   - Display and explain their models to the class.

10. **Summarize the activity using Student Page K.3.9B BUGS.**

    Ask such questions as these:
    - How many different body parts do different bugs have?

    - How did each kind of bug really walk?
      ✔ Probe to see whether their bugs walked as they predicted and fill out the observations of the chart about the ways bugs walk from Activity K.3.8 HOW BUGS WALK.
      ✔ You may want to do the bug walks again and modify movements.

EXTENSION

- Set up a center where students can use magnifying glasses to observe insects and other bugs. The center can be used anytime there are interesting things to see enlarged.

INSECT
SP K.3.9A

Name ______________________

Date ______________________

Draw your insect. Label the head, thorax, abdomen, leg, eye, wing, and antenna.

DASH

BUGS
SP K.3.9B

Name ______________________

Date ______________________

PICTURES	HOW MANY				
	LEGS	BODY PARTS	EYES	ANTENNAE	WINGS
INSECT					
SPIDER					
CRUSTACEAN					
CENTIPEDE					

K.4.4 GROWING BEAN SPROUTS

OBJECTIVES

The students
- investigate the structure of seeds
- discover the parts of plants into which different parts of the embryo will mature
- investigate a way to grow bean sprouts

BACKGROUND

GROWING BEAN SPROUTS is one of a series of activities on the study of plants. It is designed to be done concurrently with K.4.5 PLANTS AND WATER and K.5.1 BEAN SPROUT SALAD and before K.4.6 GARDENING. Other activities in the series are K.4.1 PLANT PARTS, K.4.2 PLANT ENVIRONMENTS, and K.4.3 PLANT USES.

In this activity the students first investigate the structure of a lima bean. This can be done any time before the study of sprouting. Then they follow the development of mung beans or other sprouting seeds for 5 days. At the end of the 5 days they eat the remaining sprouted seeds. See Activity K.5.1 BEAN SPROUT SALAD.

Lima bean anatomy

Soak lima beans overnight. Have the students examine a bean to find seed parts. Because lima beans are large, their parts are easily identified. See Fig. K.4.4. When the students examine their mung bean they will find that it has the same parts.

Concurrent studies

On Day 1 of this investigation 660–700 (about half a cup) of mung beans or other seeds are soaked overnight. Thirty or so dry seeds are saved for later dissection. On Day 2, two batches of seeds are wrapped in separate growing cloths. One batch contains 600 seeds; the other, 60–100 seeds. Starting on Day 3, the 60–100 seeds are not watered. The fate of these unwatered seeds is followed in Activity K.3.5 PLANTS AND WATER, which continues beyond GROWING BEAN SPROUTS through Day 8 or longer.

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The number of seeds is based on a class of 25 students, each using one germinating seed per day in each experiment and the remainder for the salad activity. There is usually 85% to 90% germination with fresh seed. Sprouting seed needs to be kept in a fairly warm environment of about 70° F for optimum growth.

The larger batch of 600–650 seeds is watered throughout this investigation with the final observation occurring on Day 5. On this same fifth day, Activity K.5.1 BEAN SPROUT SALAD is carried out using the remaining watered bean sprouts. GROWING BEAN SPROUTS can be extended several more days, but the eating quality of the sprouts will deteriorate over time.

Selection of seeds for sprouting
Mung beans are suggested for use in this experiment because they are commonly found in salads. A half cup of dried mung beans will normally be sufficient for all investigations. Because mung beans are small, the students will need hand lenses for their first observation. If mung beans are not available, try other types of small beans or radish seeds. Radishes will sprout well, but the seeds and sprouts are very small. Seeds for sprouting can usually be found in health food stores and some grocery stores.

When to start
The sprouting activity is designed to take 5 days. To complete the sprouting sequence, it should be started on a Monday and completed on a Friday.

Soaking beans
Soak the beans overnight in a jar of water to prepare them for sprouting. Do not leave them in the water for more than 24 hours or they will start to decompose. Rinse the beans before putting them on a growing cloth.

Growing cloth
A flour-sacking dish towel makes an excellent growing cloth for the larger quantity of sprouts. A smaller cloth can be used for the 60–100 seeds needed for Activity K.3.5 PLANTS AND WATER.

Keeping records
The students draw what they see each day and tape the bean- sprout parts that they observe to the student page.

Parts of seeds
Though this activity is not a study of nomenclature, students are usually curious about what things are called. For names of parts see Fig. K.4.4.

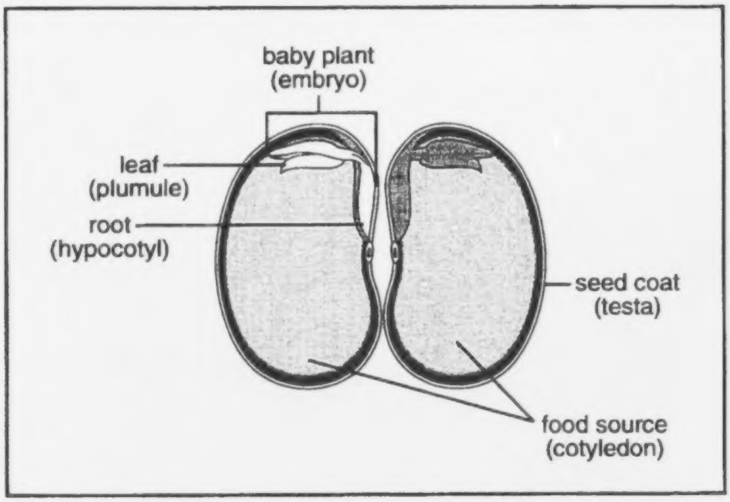
baby plant
(embryo)
leaf
(plumule)
root
(hypocotyl)
seed coat
(testa)
food source
(cotyledon)

Fig. K.4.4 Parts of a bean seed

Further growing of mung beans
It is very exciting to include mung beans as one of the food- producing plants to be grown in Activity K.4.6 GARDENING. At that time have the students predict what parts of the seed will come out of the ground. Keep all records on a chart about seed predictions.

STUDENT ROLES

Botanist
Farmer

MATERIALS

chart paper
lima beans
1/2 to 1 cup of mung beans or other seeds (small beans or radish seeds) for growing salad sprouts
2 flour-sacking dish towels
trays to hold cloths
quart jar
water source
tape
hand lenses
Student Page K.4.4 BEAN SPROUTS

PRODUCTS

Class chart of seed predictions
Completed Student Pages

PROCEDURES

1. **Begin the study of plant development by having the students open a soaked lima bean and identify the parts. Have them use hand lenses to observe small structures.**

   Help the students do the following:
   - Review the use of hand lenses.
   - Observe the outside of a seed and draw it.
     ✔ They will normally find a seed coat or thin outside covering of the seed.
   - Open a seed with a fingernail or toothpick and use a magnifying glass to observe it.
     ✔ They will find the embryo with its miniature root and leaf structures.
     ✔ In addition they will find two large, whitish starch sources that give the seed its shape.
   - Make drawings of the parts of the seed.
     ✔ Have them use Student Page 4.4.4A LIMA BEAN.
   - Tape the parts of the soaked seeds to the Student Page
   - Name the seed parts and label the lima bean. See Fig. K.4.4.
     ✔ The skin-like covering is called the *testa.*
     ✔ They should be able to find the *embryo* or baby plant with its root or *hypocotyl* and the leaf structure or *plumule.*
     ✔ In addition they will find the *cotyledons*, the large whitish food sources that give the seed its shape.
   - Put the pages with the attached seed parts in a plant press.

2. **Introduce the idea of growing bean sprouts. Start the study by examining dry seeds.**

Help the students do the following:
- Examine unsoaked bean seeds using hand lenses.
  ✔ By pulling away the dry outer coat, they can see the two halves of the seed and open the seed.
- Look for parts that look like ones they saw in the lima bean.

- On Student Page K.4.4B BEAN SPROUTS draw pictures of what they see and label them.

- Tape the seeds to the student page.

3. **Day 1. Prepare the seeds. Have the students put 1/2 cup of mung bean seeds in a jar of water. Allow the beans to soak overnight. Stress hand washing since sprouts will be eaten.**

4. **Day 2. Have the students examine the soaked bean seeds and prepare seeds for sprouting. Stress hand washing.**

Help the students do the following:
- Observe the outside of a seed and draw it.

- Compare the parts of the soaked mung bean with the parts they previously found in the lima bean.

- Make a drawing of the parts of the mung bean seed and label the parts.

- Tape the parts of the soaked seeds to the Student Page K.4.4B BEAN SPROUTS.

5. **Make a large (about 600 or more seeds) and a small (about 60–100 seeds) bean-sprout seed-roll. The larger roll will be used in the rest of this sequence. Starting on Day 3 the smaller roll will be used with Activity K.4.5 PLANTS AND WATER. Once again stress hand washing.**

- Wet two sacking dish towels by soaking them and squeezing out excess water.

- For Activity K.4.5 PLANTS AND WATER spread 60 to 100 seeds evenly down the middle of a wet flour-sacking dish towel, leaving several inches around the outside.
  ✔ Fold over the edges to keep the seed from spilling out.
  ✔ Loosely roll the cloth up.

- Spread the remaining 600 or more seeds down the middle of the second wet flour-sacking dish towel leaving several inches around the outside.
  ✔ Fold over the edges to keep the seed from spilling out.
  ✔ Loosely roll the towel up.

- Dampen the towels thoroughly and when they stop dripping place them on a tray.
  ✔ This will be the only time the batch of seed in the smaller cloth will be dampened.
  ✔ The large dish towel should be soaked once each day.
  ✔ *Do not* put water in the tray. This will drown the seeds.

6. **Discuss what is known so far about bean seeds.**

Ask such questions as these:

- What is the color of the outside of the dry seed?
  ✔ It will be the same as the color of the coat of the soaked seed.

- Can anyone point to a seed coat on your student page? What is it like?
  ✔ Get at such things as it is a very thin shell, skin, or wrapping—this is the *testa*.

- What did you find on the inside of the seed?
  ✔ With a hand lens they probably saw the *cotyledons*, the *embryo* with its *plumule* and *hypocotyl*.

- What might each of the inside parts become? Record the class chart about seed predictions.

7. **Day 3. Unroll a little of the large towel and have each of the students remove a bean for study. Once again stress hand washing.**

Have each student do the following:

- Observe the seed and draw what they see from the outside on Student Page K.4.4B BEAN SPROUTS.

- Open their seeds carefully and use a hand lens to observe the parts.

- Tape the seed parts to the student page and label them.

- Continue to soak the towel once daily and after it stops dripping, put in back in its tray.

8. **Discuss changes in the seed.**

   Ask such questions as these:
   - What does the seed look like now?
   - What do you think is coming out of the seed?
   - What do you think will happen to the seeds in the small cloth if we don't water them?
     ✔ Record predictions on the chart about seed predictions.
     ✔ Do not open the small cloth at this time.

9. **Start Activity K.4.5 PLANTS AND WATER with the seeds in the smaller cloth. Allow the cloth to dry out.**

10. **Day 4. Unroll a little more of the large cloth and have each of the students remove another bean for study. Stress hand washing since sprouts will be eaten.**

    Have the students do the following:
    - Observe the seed and draw what they see from the outside on Student Page K.4.4 BEAN SPROUTS.
    - Open their seeds carefully and use a hand lens to observe the parts.
    - Tape the seed parts to the student page and label them.
    - Continue to soak the towel.

11. **Discuss changes in the seed.**

    Ask such questions as these:
    - What does the seed look like now?
    - What do you think is coming out of the seed?
      ✔ Record predictions on the chart about seed predictions.

12. **Day 5. Unroll a little more of the towel and have each of the students remove another bean for study. Stress hand washing since the sprouts will be eaten.**

    Have each student do the following:
    - Observe the bean seed and draw what they see on Student Page K.4.4 BEAN SPROUTS.

- Open their seeds, observe the parts, tape the seed parts to the student page, and label them.

13. Ask the students questions about the seed right before it is eaten.

- What does the seed look like now?
- Were your predictions about the seed parts correct?

14. Proceed to Activity K.5.1 BEAN SPROUT SALAD.

EXTENSION

- Germinate other seeds such as alfalfa, wheat, radish, corn, or others for comparison
  ✔ Caution: DO NOT EAT sprouted seeds unless the sprouting seeds come from a health-food store and are intended for sprouting. Seeds intended for field and garden planting are often dipped in chemicals to ward off mold and insects.

DASH

LIMA BEAN
SP K.4.4A

Name ____________________

Date ____________________

Draw the opened lima bean. Label the seed parts.

DASH

BEAN SPROUTS
SP K.4.4B

Name ____________________

Date ____________________

DAY	DATE	TAPE SEED	DRAW WHAT YOU SEE
1			
2			
3			
4			
5			

1.4.6 PLANT LIFE CYCLE

OBJECTIVES

The students
- Observe the growth of plants from seed to fruiting plant.
- Observe that plants need water.
- Identify the changing structure of plants in their developmental sequence.
- Practice linear measurement skills.
- Review plant parts.

BACKGROUND

This activity is designed to provide students with a visual experience in the development of a bean plant from seed to flowering and fruiting. Students observe and keep daily records of the sequence and size of developing structures.

The activity is done in three stages. During the first stage, preparation and planting, sanitation is essential. To prevent contamination, hands should be washed whenever handling the beans. In preparing the growing chambers, it is probably best to have the holes in the cups prepunched. Have the students work along as you demonstrate the assembling and planting in the double-cup growing chamber. Be sure the water tray is deep enough so that water will reach the holes in the bottom of the inside cup.

Have the students invent their own system of data collection for stage two, observation and germination. They should observe growth of plants in both the inside and outside cups. When the beans between the cups become moldy or dried, discard the outside cup and continue observing only the beans in the inside cup.

The third stage, maturation, takes the growth of the plants to the point where they flower and fruit. When the plants are 10–12 cm tall, transplant them (cups and all) into a gallon can. After transplanting, they can be put outside in the sun during the day when the temperature is warm enough.

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STUDENT ROLES

Botanist
Farmer

MATERIALS

clear, plastic cups—soft, flexible
paper toweling
scissors
bleach
jar for soaking beans
shallow pan for water
cup or jar to carry water
potting soil
bean seeds (lima or bush beans)
string
metric rules
bean sprouts
hand lenses
paper
gallon cans
Student Page 1.4.6 GROWING A BEAN PLANT

PRODUCTS

Growing bean plants
Student pictures
Completed Student Pages

PROCEDURES

1. **Set the stage by showing students some bean sprouts and having them recall the bean sprouts they grew in kindergarten.**

   Some suggested questions are
   - What do you think bean sprouts are?
   - What do you think they were before they were bean sprouts?
   - What do you think would have happened to the sprouts if we had continued to let them grow?
   - What would you like to know about bean sprouts?

Explain that to answer these questions we can grow beans so that we can see them as they grow.

2. **Prepare the beans for planting.**

   - Soak the bean seeds overnight in water.

   - Kill mold by washing the seeds in a bleach solution
     ✔ 5 ml bleach or 1 tsp to 1 liter or 1 qt of water
     right before planting and then rinsing in clean water.

3. **Using a hand lens, have students observe a soaked seed before planting.**

   Have them
   - Remove the seed coat and look at it.

   - Tell what they think the seed coat might do for the seed.

   - Open up a bean and look inside.

   - Tell what they think the structure might become.

   - Draw a picture of what they see.

   - Tell what else they would like to know about seed growth.

4. **Assemble the double-cup growing chamber.**

   - Punch holes in the bottom of two wide, flexible, plastic cups of the same size.

   - Line the outside of one clear plastic cup with damp paper toweling.

   - Place the paper-covered cup inside the other cup.

   - Fill the inside cup with moist, garden-quality soil. See Figure 1.4.6.

5. **Have students plant the seeds and set their growing chambers in a water pan.**

   - Plant three seeds between the paper and the outside cup so that the seed can be seen.

- Plant three seeds in the soil about 4–5 cm (1 1/2–2 in) deep.
- Place planted cups in a shallow tray that has 1–2 cm (1/3–2/3 in) of water. Water will go through the holes in the bottom of the cups and keep the towel and soil moist.

6. **Have students observe and record data on the growing seeds on Student Page 1.4.6 GROWING A BEAN PLANT.**

    - Discuss and agree upon the kinds of things that will be recorded.
    - Observe and record the developing plant structures.
    - Measure and record the length of structures. Use a wet string stuck to the outside of the cup to measure twisted or curved roots and stems. Stretch the string out and measure its length.
    - Continue until the seed beans are moldy or dried. Then remove the outside cup, beans, and paper. Continue with the inside cup alone.
    - Observe the emergence of the developing structures from the inside cup. Draw, label, and measure the length of the stem regularly. Record dates.
    - If more than one seed germinates, the population should be reduced to one plant by the end of the 2nd or 3rd week.
    - Ask students for their questions and investigations.

7. **When the bean plants are in danger of tipping over, transplant them, along with their cups, into a coffee can of moist soil.**

    - Enlarge the holes in the plastic cup. Roots will shortly go through the holes in the cup into the soil of the can.
    - Holes in the bottom of the can will keep the plants moist when set in water.

8. **Discuss and summarize the activity with students.**

    Some suggested questions are
    - What did the parts of the embryo in the seed develop into?

- What does the bean plant need to grow?
- What does the bean plant need soil for?
- Where do the seeds of beans come from?
- What do you think will happen to the bean plant after the beans are harvested?

EXTENSIONS

- Have students work with growth sequence cards in the science centers.
- Have students create a developmental mural on beans with the growth data.

ILLUSTRATION

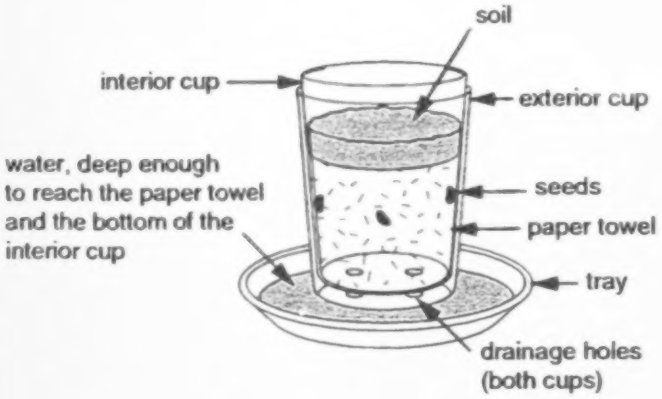
soil
interior cup
exterior cup
water, deep enough to reach the paper towel and the bottom of the interior cup
seeds
paper towel
tray
drainage holes (both cups)

FIGURE 1.4.6 Double-Cup Growing Chamber

DASH

GROWING A BEAN PLANT 1.4.6

Name: ______________________

Date: ______________________

OUTSIDE CUP		INSIDE CUP	
DATE	OBSERVATIONS	DATE	OBSERVATIONS

1.10.3 TESTING FOR WATER

OBJECTIVES

The students
- Test things for the presence of water using cobalt chloride paper.
- Observe that water can be driven out of things as a vapor.
- Observe that water is in many things around us.
- Observe that water is present in all living things.

BACKGROUND

This activity introduces the study of water. It is built around an ongoing inventory. Students are to find how many different things contain water.

Students will use cobalt chloride paper to test for water. Blue cobalt chloride paper touched to water turns red. When it is dried in the hot sun or gently warmed over a heat source, it turns back to its original blue color for reuse. Tiny pieces of the paper work well.

To make cobalt chloride paper, dissolve 10g of cobalt chloride in 100 ml of water. Saturate absorbent paper (filter paper, paper towel, etc.) in the solution. Dry the paper in the sun or a slightly warm oven. Cut into strips and store in an airtight jar.

Caution: Cobalt chloride solution is toxic if ingested. It may irritate eyes, skin, and respiratory system. Wash hands after handling.

Water can be removed from many substances. Put the substance in a Pyrex container and heat it on a hot plate. Collect the water on a cool glass or porcelain surface held above the container. Use tweezers and tongs. Touch the blue cobalt chloride paper to any visible moisture that collects. Clear liquids can be tested directly (saliva, tears, sweat, etc.). For most liquids the test paper can be used again after it is dried. If the paper is soiled, throw it away.

Set up a water-testing activity center. Be sure to discuss and post safety rules. Make a class chart to record what substances students have found that contains water. The teacher's role is that of program

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manager and consultant. New materials to be tested by heating should be screened by the teacher. Material is acceptable for heating unless it is foul smelling, highly flammable, petroleum-based, or appears dangerous.

STUDENT ROLE

Scientist

MATERIALS

chart paper
markers
a jar of unused cobalt chloride paper
a jar for used cobalt chloride paper
a hot plate
a small Pyrex heating container (a beaker will work)
a glass or porcelain surface on which to collect moisture (a jar or dish will work)
tongs
tweezers
hot mitts
tempera paint
rubbing alcohol
milk
Student Page 1.10.3 TESTING FOR WATER

PRODUCTS

Class chart things that contain water
Completed Student Pages

PROCEDURES

1. **Introduce the activity with a class discussion about water being necessary for living things.**

   Ask such questions as these:
   - Do we contain water?
   - Do other animals contain water?
   - Do plants contain water?
   - How might we find out whether something contains water?

2. **Demonstrate the use of cobalt chloride paper as a water detector.**

   - Show how it changes from blue to red when dipped in water.
   - Show how to get the cobalt chloride paper to turn back to blue by slightly heating it or putting it in the sun.
   - Have students test their saliva and rubbing alcohol.
     ✔ Saliva contains water; rubbing alcohol does not.

3. **Show students the way to find out whether things that stain the paper have water (milk, paints, etc.).**

   - Heat milk in a Pyrex container on a hot plate.
   - Condense some vapor on a cool glass.
     ✔ The vapor will be seen to rise from the milk.
     Use tongs to hold the glass.
   - Test the moisture with cobalt chloride paper.

4. **Show students that things that seem dry may contain water.**

   Heat some leaves in a Pyrex container and test the vapor for water.

5. **Set up a water activity center, divide students into working teams and make rules for doing investigations, and have students make a class chart things that contain water.**

   Some suggested rules are
   - Check with teacher if the material is safe to test.
   - Use the hot plate only with teacher supervision.
   - Use tongs and hot mitts to handle hot things.
   - Be sure to record and validate your results.

   The Class Chart should include
   - What was tested.
   - The result of tests (water or no water found).
   - Who ran the test.

- The date of the test.
- Result of the validation test.
- Who ran the test.
- Date of the test.

Teams must validate their own work. Someone from a different group may run the same test for further validation.

6. **Summarize and discuss the activity with the class.**

Ask questions such as the following
- In what kinds of things did you find water?
- What kinds of things did you find that contained no water?
- Do living things seem to contain water? What kinds of living things?
- Do once-living things seem to contain water? What kinds of once-living things?
- Do non-living things seem to contain water? What kinds of non-living things?

DASH

TESTING FOR WATER
SP 1.10.3

Name: ____________________

Date: ____________________

DATE	SCIENTIST	MATERIAL TESTED	RESULTS		VALIDATION TEST		
			YES WATER	NO WATER	WHO?	DATE	YES/NO

1.10.7 BUBBLES IN WATER

OBJECTIVES

Students
- Predict the behavior of air in water.
- Observe the behavior of air in water.
- Observe the behavior of containers in water.

BACKGROUND

BUBBLES IN WATER is usually followed by Activities 1.10.8 BUBBLES IN AIR, and 1.10.9 BUILDING WITH AIR. BUBBLES IN WATER is a semi-directed activity designed to study containers and bubbles in water. It shows that a gas can be captured, confined, controlled, and quantified.

Containers

The activity is done in an aquarium, a glass gallon jar, or a clear plastic bag viewing box. A viewing box is made by cutting windows in the side of a cardboard box, lining the box with clear plastic, and filling it with water.

STUDENT ROLE

Experimenter

MATERIALS

aquariums, gallon jar, or cardboard viewing boxes
buckets
tubing or straws
graduated jars
mops
newspapers
Student Page 1.10.5 BUBBLES IN WATER

PRODUCT

Class chart bubbles in water
Completed Student Pages

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PROCEDURES

1. **Have students predict what they think a bubble of air will do and what it will look like in water. Record the predictions on Class chart Bubbles In Water. Have students test their predictions by blowing bubbles into water. Record observations on the chart.**

   Ask such questions as these:
   - Where did the bubbles go?
   - Did they go straight?
   - What is the shape of small bubbles?
   - What is the shape of large bubbles?
   - Do bubbles change their shape? If so, how?
   - Do little bubbles act the same as big bubbles?
   - Do some bubbles seem to move faster than others?
   - What kinds of bubbles move fastest? How did you test this?
   - What happens when you have a whole lot of bubbles at one time?
   - What questions do you want to find out about bubbles? Try to find answers.

2. **Have students share their questions and answers. Add this information to the class chart bubbles in water.**

3. **Have students put a jar under water, mouth *up*. Have them lift it out of the water to find out what happens and how it feels.**

   Ask such questions as these:
   - How does the jar feel as it gets further and further out of the water?
   - How much water are you bringing up?

- What happens when you blow bubbles of air into the mouth of a submerged jar when its mouth is turned up.

4. **Have students put a jar *upside* down in water. Have them lift it out of the water to find what happens and how it feels.**

   Ask such questions as these:
   - How does the jar feel as it gets further and further out of the water?
   - How much water are you bringing up?
   - How is this experiment different from the one in which we had the mouth of the jar turned up? How is it similar?
   - What happens when you blow bubbles into the mouth of the submerged jar when its mouth is down?

5. **Have students experiment freely with bubbles and air to answer their own questions. Use Student Page 1.10.5 BUBBLES IN WATER to record their ideas. Do not help them with questions unless they run out of ideas.**

   Questions such as the following may be used.
   - What happens to the air in the jar?
   - Do bubbles coming out of the water in the jar seem to leave the aquarium?
   - How does the jar partly filled with water feel as it gets further and further out of the water?
   - You can put air into a jar underwater. Can you take it out?
   - Can you pour water from one container to another under water?

6. **Have students report on their experimentation.**

   Ask such questions as these:
   - Do our observations help us think about air as being something? If so how?
   - How might we measure the amount of air underwater.

EXTENSION

- Create a Bubbles in water center and have the students continue to explore and report what they find.

DASH

BUBBLES IN WATER
SP 1.10.7

Name: ____________________

Date: ____________________

BUBBLE QUESTIONS	WHAT DID YOU DO?

1.10.8 BUBBLES IN AIR

OBJECTIVES

The students
- Invent ways of making bubbles of different sizes.
- Observe bubbles in air.
- Compare bubbles in air and bubbles in water.

BACKGROUND

In this activity students compare the shapes, movement, and other properties of soap bubbles in air with air bubbles in water. This is an open-ended inquiry with the questions coming from students.

This is an outdoor activity.

For bubble solution, mix
- 1 cup Dawn or Joy liquid detergent
- 10 cups water
- 1/4 cup glycerin or corn syrup (Both are optional.)

CAUTION: Some people are allergic to glycerin and/or detergent. Either may cause eye or skin irritation.

Bubbles do best in high humidity. Just after a rain or early morning are excellent times. Add a bit more water to the solution if results are not satisfactory.

STUDENT ROLES

Experimenter
Inventor

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MATERIALS

chart paper
markers
Styrofoam cups
straws
string
Styrofoam plates or meat trays (Holes can be made for bubble making.)
soft drink plastic holders for 6-packs
dish pan for solution
light corn syrup or glycerin
Dawn or Joy detergent
Student Page 1.10.8 BUBBLES

PRODUCTS

Class chart bubbles in air
Bubble makers
Completed Student Pages

PROCEDURES

1. **Have students invent bubble makers and prepare the bubble solution.**

   Bubble makers can be made from Styrofoam cups, plates and trays, straws, straws and string, and plastic 6-pack holders. Use the Inventor's Box to stimulate ideas.

   Demonstrate the use of bubble makers.

2. **Have students suggest things to observe and questions to answer.**

   Make a Class Chart BUBBLES IN AIR.

3. **Have students investigate bubbles of air in air.**

   This is an activity best done outdoors.

4. **Record student observations of soap bubbles on the class chart bubbles in air. Compare observations with bubbles in ware (Act. 1.10.7). Record comparisons on Student Page 1.10.8 BUBBLES or another class chart.**

Some suggested questions are

- How were bubbles in air different from bubbles in water?
- How were bubbles in air similar to bubbles in water?
- Which were bigger?
- Which were smaller?
- Did they float the same way?
- When did bubbles in air seem to float up high?
- What other observations did you make?
- What questions did you ask and what answers did you find?

DASH

BUBBLES
SP 1.10.8

Name: ______________________

Date: ______________________

PROPERTY	BUBBLES IN WATER	BUBBLES IN AIR

DASH

GRADE 2

ACTIVITY PLANS

Grade 2 DASH: Suggested Year 1 Activity Plan

CLUSTER	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE
1. Learning	2.1.1-LC,RespCh	2.1.1-LC 2.1.2-SRB, W&D,WD (classif)	2.1.1-LC	2.1.1-LC	2.1.1-LC	2.1.1-LC 2.1.4-Gls (2.1.13-C&SInv)	2.1.1-LC	2.1.1-LC	2.1.1-LC	2.1.1-LC	2.1.1-LC 2.1.4-Gls 2.1.13-C&SInv
2. Time, Weather, & Sky		2.2.1-Temp 2.2.2-Wind 2.2.5-Rain 2.2.3-Data	2.2.3-Grph Sunrs/set 2.2.7-8-Time	2.2.3-SnG	2.2.1-Tmp 2.2.3-SnG	2.2.4-Moon 2.2.3-SnG	2.2.3-SnG 2.2.4-MG (2.2.6-Snow)	2.2.1-Tmp 2.2.3-SnG 2.2.4-MG	2.2.3-SnG 2.2.4-MG	2.2.1-Tmp 2.2.3-SnG 2.2.4-MG	
3. Animals	2.3.14						2.3.1-3 Fish				
4. Plants									2.4.1-2-Soi 2.4.9-VgGr (2.4.16-Tree)	2.4.7-MvWater	
5. Food and Nutrition				2.5.3-FdG (2.5.7-9-Milk,Chee)				(2.5.3FdG) 2.5.10-FdEnrgy			
6. Health and Safety	2.6.1-GrCh (2.6.2-Teeth)		2.6.7-9-Safety				(2.6.2-Teeth)				2.6.1-GrCh (2.6.2-Teeth)
7. Way-finding						2.7.10-11-Pulleys				2.7.2-3-RaceCars	
8. Energy & Communication								2.8.2-MirrorSun (2.8.4-Temp)			
9. Conserv., Recycling, & Decompos.		2.9.1-2-Bury						(2.9.6-Recyc)		2.9.3-4-DigUp	
10. Matter, Space, & Construction				2.10.2-Volume			2.10.1-MSCan	2.10.1-Balance			
NOTES ORG IDEAS	LearnCal Records Start Up	Weather	Time Safety	Food Volume		Moon Pulleys	Fish	Energy Mass	Soil & Plants	Cars	Finish Up

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Grade 2 DASH: Suggested Full Implementation Activity Plan

CLUSTER	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE
1. Learning	2.1.1-LC,RespCh	2.1.1-LC 2.1.2-LYr 2.1.8-Fam	2.1.1-LC 2.1.6-7-Friends	2.1.1-LC 2.1.9-10 Pred&Pln	2.1.1-LC	2.1.1-LC 2.1.3-5 Gls&Hlp 2.1.13-CSI	2.1.1-LC	2.1.1-LC 2.1.11-Thk	2.1.1-LC	2.1.1-LC 2.1.11-Thk	2.1.1-LC 2.1.4-Gls 2.1.13-CSI 2.1.12-Lib
2. Time, Weather, & Sky		2.2.1-Temp 2.2.2-Wind 2.2.5-Rain 2.2.3-Data	2.2.3-Grph Sunrs/set 2.2.7-8-Time	2.2.3-SnG	2.2.1-Tmp 2.2.3-SnG	2.2.4-Moon 2.2.3-SnG	2.2.3-SnG 2.2.4-MG (2.2.6-Snow)	2.2.1-Tmp 2.2.3-SnG 2.2.4-MG	2.2.3-SnG 2.2.4-MG	2.2.1-Tmp 2.2.3-SnG 2.2.4-MG	
3. Animals	2.3.14						2.3.1-4 Fish		2.3.5-8-Insects 2.3.9-13-Spiders		
4. Plants								2.4.9-10-Gardens 2.4.11-Sun	2.4.1-5-Soi 2.4.12-15-Roots 2.4.16-Tre	2.4.6-8-MvWater	
5. Food and Nutrition				2.5.1-9-Food	2.5.1-9-Food (con't)			(2.5.3FdG) 2.5.10-FdEnrgy			
6. Health and Safety	2.6.1-GrCh		2.6.4-9-Safety				2.6.2-3-Teeth				2.6.1-GrCh
7. Way-finding						2.7.9-12-Pulleys				2.7.1-8-Cars & Village	
8. Energy & Communi-cation								2.8.1-4-Sun Energ (2.8.5-Eclipse)			
9. Conserv., Recycling, & Decompos.		2.9.1-2-Bury							2.9.5-6-Pollut & Recyc	2.9.3-4-DigUp	2.9.7-Connect
10. Matter, Space, & Construction				2.10.2-Volume		2.10.1-2-Organiz	2.10.1-MSCan	2.10.1-Balance			
NOTES ORG IDEAS	LearnCal Records Start Up	Weather	Time Safety	Food Volume	Food	Moon Pulleys	Fish	Energy Mass	Soil & Plants	Cars	Finish Up

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DASH Activities School Year Planning Form

CLUSTER	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE
1. Learning											
2. Time, Weather, & Sky											
3. Animals											
4. Plants											
5. Food and Nutrition											
6. Health and Safety											
7. Way-finding											
8. Energy & Communication											
9. Conserv., Recycling, & Decompos.											
10. Matter, Space, & Construction											
NOTES and ORGANIZING IDEAS											

DASH

GRADE 2

SCOPE & SEQUENCE

ACTIVITY LISTS

GRADES K–5 DASH SCOPE AND SEQUENCE OF ACTIVITIES

CLUSTER	GRADE K	GRADE 1	GRADE 2	GRADE 3	GRADE 4	GRADE 5
Learning	Learning Calendar Home Learning Calendar Calendar Review Responsibility Chart Science Record Book Using Our Senses Same and Different Physical Characteristics Functions of Things Working Dictionary Wonder and Discover Book Connections Book Families Families and Helping Making Friends Being Friends School and Home Concept and Skill Inventory	Learning Calendar Responsibility Chart Planning Calendar Last Year Helping Working Together Taking Turns and Sharing Concept and Skill Inventory	Learning Calendar Last Year Aphorisms Helping Others Getting Help Making and Keeping Friends Turns School, Teacher, Friends, and Family Predictions about Tomorrow Planning for Tomorrow Thinking Library Concept and Skill Inventory	Learning Calendar Last Year Responsibility Planning Organizing Our Environment Friends Giving and Receiving Working Together Helping Myself and Others Aphorisms Next Year Science & Technology Concept and Skill Inventory	Learning Calendar Responsibility Last Year Library Working Together Things I Can Do for Myself and Others Aphorisms Planning Survival Game Concept and Skill Inventory	Learning Calendar Responsibility Library Working Together Things I Can Do for Myself and Others Aphorisms Friendship Concept and Skill Inventory
Time, Weather, and Sky	Weather Watch Beginnings Endings Day and Night Days, Weeks, and Months Moon Watch Moon Phases Seasons Clocks and Calendars	Sky and Weather Watch Rain and Streams Snow and Streams Digital Clock Hours and Minutes Time Line Sunrise and Sunset Night and Day The Sun The Seasons Making a Clock	Temperature Wind Sunrise, Sunset, and Seasons Moonrise and Moonset Rain Snow Digital Time Analog Time	Weather Temperature Wind Rain and Snow Humidity Sunrise and Sunset Moon Phases Polar Sky Model Polar Constellations Venus Eclipses	Rainfall and Snowfall Wind Direction & Speed Height of Clouds Clouds and Weather Storm Clouds Humidity and Wind Chill Lightning Weather Maps Weather Fronts Predicting Weather Flat or Round Earth? Length of Day and Night The Sun's Shadow Path The Planetarium Planets When Is It Noon? Making and Using a Sundial Seasons and the Sun Moon Phases and the Sun Eclipses	Weather Station Heat Index Weather Prediction Clouds and Fronts Triangles Gnomon Size of Earth Moon Through a Telescope How Big and Far Away Is the Moon? Paths of Celestial Bodies Models of the Solar System

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GRADES K–5 DASH SCOPE AND SEQUENCE OF ACTIVITIES

CLUSTER	GRADE K	GRADE 1	GRADE 2	GRADE 3	GRADE 4	GRADE 5
Animals	Appropriate Pets Classroom Animals Caring for Animals Living, Once-living, and Nonliving Things Animals and Plants Animal Environments Uses for Animals How Bugs Walk Parts of Bugs Parts of Mammals People Animals and Food Animals and Water Animals and Air Animal Wastes How Animals Keep Warm How Animals Keep Cool Real or Imaginary	Classroom Pets Living &and Nonliving Things Defining Living and Nonliving Things Animal Survey Animal Key Animal Needs Planning to Raise a Small Animal Building Cages Metamorphosis	Classroom Pets Classroom Aquarium External Anatomy of Fish Biological Needs of Fish Reproduction and Development of Fish Finding Insect Eggs Hatching Insect Eggs Early Metamorphosis Late Metamorphosis Collecting Spiders Insects and Spiders Spider Food Spider Care Spiders as Predators Spider Webs	Classroom Pets Raising Insects Comparing Insects Importance of Insects Frog and Toad Habitats Raising Frogs and Toads Frog Metamorphosis Importance of Frogs and Toads Toads and Insects Hatching Chicks Chick Growth Importance of Birds	Pet Care Unincubated Egg Chick Embryology Raising Small Mammals Reproduction of Pet Mammals Pet Baby Care Our Early Years The First Grade Child Development of Pets Human Development Changing Dimensions Anatomy of Fish Fish Reproduction Digestive, Circulatory, and Reproductive Systems Migration and Hibernation Fall, Winter, and Spring Birds	Pet Care Birds I Know Cells Male Urogenital System Female Urogenital System Ovulation Cycle Ovulation and Pregnancy Embryology Body Changes Bones Skeletal System Muscles Muscular System Chemistry and Bones The Senses The Eye Sound The Ear
Plants	Plant Parts Plant Environment Plant Uses Growing Bean Sprouts Plants and Water Gardening	Plant Identification Plant Survey Plant Pressing Plant Key Plant Needs Plant Life Cycle Edible Plant Parts Plant Parts Animals Eat	Soil Making Soil Soil and Plants Soil Uses Finding Soil Pipes and Water Moving Water: Gravity Moving Water: Pumps Vegetable and Flower Gardens in a Bucket Rooting Stems Rooting Bulbs and Tubers Roots and Water Growing Root Vegetables Tree Planting	Garden Planning Garden Preparation Watching Garden Soil Making Artificial Soil Testing Soil Soil and Water Garden Planting Garden Care Watering Systems Garden Invaders Controlling Insects Garden Harvesting Flowers Seeds Pollination	Annual, Biennial, and Perennial Plants Fungi	Annual, Biennial, and Perennial Plant Project Tree Harvesting Tree Planting Tree Observation Measuring Trees Age of Trees Trees, Shrubs, and Grasses Grasses: Why Do They Grow There? Roots Soil Conservation
Food and Nutrition	Bean Sprout Salad Drinks Flour and Bread Familiar Foods Favorite Foods New Foods	Food Groups Cooking Measuring Volume	Supermarket Survey Food Preference Food Groups New Foods Properties of Foods Changing Flavor Milk, Butter, and Cheese Energy from Food	Nutritious Food Selection Plants for the Garden Class Feast Drying and Pickling Foods Preserving and Rotting Supermarket Game Pricing Foods Food Ads	Nutrients Mechanical Digestion Chemical Digestion Food Groups Preserving Foods	Nutrients Nutrients and Cells Food Labeling

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GRADES K–5 DASH SCOPE AND SEQUENCE OF ACTIVITIES

CLUSTER	GRADE K	GRADE 1	GRADE 2	GRADE 3	GRADE 4	GRADE 5
Health and Safety	Growth Chart Tooth Chart Tooth Care Exercise Germs Washing Hands Bathrooms and Basins Aprons Fountains and Faucets Getting Sick Feeling Sick Going to the Doctor What Doctors Do Going to the Hospital Raincoats Testing Raincoats Wet and Cold Keeping Warm Indoors Hand and Foot Protection Getting Lost	Growth Chart Tooth Chart Brushing Teeth Chewing Air and Breathing Getting Hurt Staying Healthy Safety Rules	Growth Chart Tooth Chart Tooth Care Getting Hurt Getting Sick Staying Well Classroom and Playground Safety Fire Safety Using 911	Growth Chart Tooth Chart Breathing Air Anatomy of Breathing Lung Model Lungs and Smoking Breathing and Pulse Heart, Veins, and Arteries Heart, Lungs, and Exercise Disease Transmission Trash and Sanitation Helpful Drugs Proper Drug Use	Growth Chart and Area Measurement Tooth Chart Safety Gear Safety and Putting Out Fires Making a Fire Things That Burn Smoking and the Lungs Alcohol, Tobacco, and Drugs	Growth Chart and Area Measurement Tooth Chart Alcohol, Tobacco, and Drugs Sexually Transmitted Diseases Safety Devices Smokers' Surveys Smoking Laws Alcohol Laws Chris's Story The Parents' Story Intoxication Drug Laws
Wayfinding and Transportation	Right and Left Sunrise Sunset North and South Rising Moon Setting Moon Home Location Sidewalks & Walkways Roads Traffic Simulation Traffic Rules Mapping	Pacing North, South, East, and West Home Map Distance Making a Boat Making a Lake The Great Regatta Floating and Sinking Draining a Lake	Transportation Systems Making Race Cars Racing Cars Roads Building a Village Pedestrians in the Village Bikes in the Village Cars in the Village Bikes and Trikes Belts and Pulleys Fast and Slow Pulleys Gears and Wheels	Garden Mover Propeller-Driven Message Center Propeller-driven Boat Delivery Systems	Boat Design Wind and Sails	Where in the World Are We? Planetarium Mapping the Sky The North Pole, Equator, and Ecliptic Where Is Earth?

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GRADES K–5 DASH SCOPE AND SEQUENCE OF ACTIVITIES

CLUSTER	GRADE K	GRADE 1	GRADE 2	GRADE 3	GRADE 4	GRADE 5
Energy and Communication	Energy Making Things Move Making Things Stop Turning Things Off Turning Things On Repairing Things	Temperature of Things Master Thermometer Hot and Cold Sources of Energy	Sun and Direction Mirrors and Sunlight Clouds and Sunlight Comparing Temperatures Eclipses	Shadow, Light, and Bubbles Wind and Heat Wind Pulls and Pushes Propellers Driving Propellers Waterwheels Propellers in Water Heliograph Speaking Tube String Telephone Energy Definitions	Push-Pull Measuring Tool Friction Streamlining Pressure, Sharp Edges, and Points Energy of Falling Objects Circles and Speed	Pushes, Pulls, & Forces Teeter-Totters The Balance Wheels and Axles Levers Arms and Jaws Inclined Planes and Screws Block and Tackle Magnetic Pushes and Pulls Magnets and Compasses Magnetic Fields Forces Projects
Conservation, Recycling, and Decomposition	Decomposition Waste Disposal Recycling Project Making Paper	Classroom Resources Conserving Energy Conserving Water Decomposition and Unearthing Decomposition and Reburial Recycling	Fall Unearthing Fall Burying Spring Unearthing Spring Burying Pollution Survey Aluminum Recycling Connections	Making Compost Watching Compost Animals in Compost Using Compost Fall Unearthing and Burial Spring Unearthing and Burial	Unearthing and Burial Recycling Project	Class Recycling Project Class Conservation Project Decomposition and Archeology Pollution Project
Matter, Space, and Construction	Cubby Organization Patterns in Puzzles Making Puzzles Making Envelopes Making Boxes and Bags Volume of Boxes and Bags Packing and Storing Linear Measurement	Meter-string Can Outdoor Study Area Mapping Testing for Water Measuring Volume Plumbing Water Systems Air Bubbles in Water and Air Building with Air Floor Plan Cardboard House Plan Making a Cardboard House Painting the House Furnishing the House Sewing and Weaving Warming andCooling Lighting the House	Desk Organization Notebook Organization The Balance Meter-string Can Measuring Volume	Acidic and Basic Soil Acids and Bases Acid and Base Reactions Diluting Acids and Bases Acid and Base Interactions Dissolving Things Things in Liquids Crystals Rain in a Jar Supermarket Planning Supermarket Construction Measuring Devices Safety Equipment	Linear Measurement Volume Measurement Mass Measurement Collecting Rocks Hardness of Rocks Specific Gravity Rocks and Sharp Edges Making Tools from Rock Clowns: Things That Float Clay Fire and Pottery Air and Fire Fire and Oxygen Properties of Gas	Linear Measurement Volume Measurement Mass Measurement Camera Obscura Controlling Light with Lenses Making a Telescope Stabilizing the Telescope Making a Microscope Making a Hygrometer Making a Barometer

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GRADE 6 SCOPE AND SEQUENCE OF ACTIVITIES

Learning	**Time, Weather, and Sky**	**Animals**	**Plants**	**Food and Nutrition**
Learning Calendar Last Year Mars Mission Tomorrow The Work World Goals Crash Simulation Mars Compact Martian Simulation The Mission Conference Concept and Skill Inventory	Weather Station Weather Around the United States Weather and Local Climate Wind Hypotheses Producing Winds Air Pressure and Altitude Wind and Water Altitude and Temperature Models of Air Climatic Regions Climate of Mars	Animal Care Raising Fish Raising Worms Food Chains	Hydroponics Algae Nutrients and Biological Waste Water Pollutants	Nutrient Tables The Kilocalorie Weight Watching Meal Planning Food for Space Fish and Algae for Dinner
Health and Safety	**Wayfinding and Transportation**	**Energy and Communication**	**Conservation, Recycling, and Decomposition**	**Matter, Space, and Construction**
Growth Chart Tooth Chart Safety Disease Literature Sanitation Disease Prevention and Treatment Sexually Transmitted Diseases Drug Abuse Prevention and Treatment Alcohol and Tobacco Addiction, Prevention, and Treatment Environmental Disease Transmission, Prevention, and Treatment Exercise and Health and the Mars Mission	Flying Airplanes Flying Rockets Spacecraft The Orbit of Mars What Path to Mars?	Rocket Propulsion Magnetism Electrostatics Electrical Circuits Rock Formation Metals from Ores Asymmetrical Levers	Recycling Project Conservation Decomposition: A Summary Pollution	Making Measuring Equipment Making a Balance Making an Electroscope Making Electromagnets and Current Indicators Electric Cells Making an Electric Motor Making an Electric Signaler Making a Martian Survival Habitat

DASH K
ACTIVITY LIST

CLUSTER 1 LEARNING

K.1.1 THE LEARNING CALENDAR
K.1.2 THE CLASS RESPONSIBILITY CHART
K.1.3 CALENDAR REVIEW
K.1.4 THE HOME LEARNING CALENDAR
K.1.5 THE SCIENCE RECORD BOOK
K.1.6 USING OUR SENSES
K.1.7 SAME AND DIFFERENT
K.1.8 PHYSICAL CHARACTERISTICS OF THINGS
K.1.9 FUNCTIONS OF THINGS
K.1.10 THE WORKING DICTIONARY AND WORKING DEFINITIONS
K.1.11 THE WONDER AND DISCOVER BOOK
K.1.12 THE CONNECTIONS BOOK
K.1.13 FAMILIES
K.1.14 FAMILIES AND HELPING
K.1.15 MAKING FRIENDS
K.1.16 BEING FRIENDS
K.1.17 SCHOOL AND HOME
K.1.18 CONCEPT AND SKILL INVENTORY

CLUSTER 2 TIME, WEATHER, AND SKY

K.2.1 WEATHER WATCH
K.2.2 BEGINNINGS
K.2.3 ENDINGS
K.2.4 DAY AND NIGHT
K.2.5 DAYS, WEEKS, AND MONTHS
K.2.6 MOON WATCH
K.2.7 MOON PHASES
K.2.8 SEASONS
K.2.9 CLOCKS AND CALENDARS

CLUSTER 3 ANIMALS

K.3.1 APPROPRIATE PETS
K.3.2 CLASSROOM ANIMALS
K.3.3 CARING FOR CLASSROOM ANIMALS
K.3.4 LIVING, ONCE-LIVING, AND NOT-LIVING
K.3.5 ANIMALS AND PLANTS
K.3.6 ANIMAL ENVIRONMENTS
K.3.7 USES FOR ANIMALS
K.3.8 HOW BUGS WALK
K.3.9 PARTS OF BUGS
K.3.10 PARTS OF MAMMALS
K.3.11 PEOPLE
K.3.12 ANIMALS AND FOOD
K.3.13 ANIMALS AND WATER
K.3.14 ANIMALS AND AIR
K.3.15 ANIMAL WASTES
K.3.16 HOW ANIMALS KEEP WARM
K.3.17 HOW ANIMALS KEEP COOL
K.3.18 REAL OR IMAGINARY

CLUSTER 4 PLANTS

K.4.1 PLANT PARTS
K.4.2 PLANT ENVIRONMENTS
K.4.3 PLANT USES
K.4.4 GROWING BEAN SPROUTS
K.4.5 PLANTS AND WATER
K.4.6 GARDENING

CLUSTER 5 FOOD AND NUTRITION

K.5.1 BEAN SPROUT SALAD
K.5.2 DRINKS
K.5.3 FLOUR AND BREAD
K.5.4 FAMILIAR FOODS
K.5.5 FAVORITE FOODS
K.5.6 NEW FOODS
K.5.7 SNACKS FROM THE GARDEN

CLUSTER 6 HEALTH AND SAFETY

K.6.1 GROWTH CHART
K.6.2 TOOTH CHART
K.6.3 TOOTH CARE
K.6.4 EXERCISE
K.6.5 GERMS
K.6.6 WASHING HANDS
K.6.7 BATHROOMS AND BASINS
K.6.8 APRONS
K.6.9 FOUNTAINS AND FAUCETS
K.6.10 GETTING SICK
K.6.11 FEELING SICK
K.6.12 GOING TO THE DOCTOR
K.6.13 WHAT DOCTORS DO
K.6.14 GOING TO THE HOSPITAL
K.6.15 RAINCOATS
K.6.16 TESTING RAINCOATS
K.6.17 WET AND COLD
K.6.18 KEEPING WARM INDOORS
K.6.19 KEEPING COOL INDOORS
K.6.20 HAND AND FOOT PROTECTION
K.6.21 GETTING LOST

CLUSTER 7 WAYFINDING AND TRANSPORTATION

K.7.1 RIGHT AND LEFT
K.7.2 SUNRISE
K.7.3 SUNSET
K.7.4 NORTH AND SOUTH
K.7.5 HOME LOCATION
K.7.6 SIDEWALKS AND WALKWAYS
K.7.7 ROADS
K.7.8 TRAFFIC SIMULATION EQUIPMENT
K.7.9 TRAFFIC SIMULATION MAPPING
K.7.10 TRAFFIC SIMULATION RULES
K.7.11 CLASSROOM MAPPING

CLUSTER 8 ENERGY AND COMMUNICATION

K.8.1 ENERGY
K.8.2 MAKING THINGS MOVE
K.8.3 MAKING THINGS STOP
K.8.4 TURNING THINGS OFF
K.8.5 TURNING THINGS ON
K.8.6 REPAIRING THINGS

CLUSTER 9 CONSERVATION, RECYCLING, AND DECOMPOSITION

K.9.1 DECOMPOSITION
K.9.2 WASTE DISPOSAL
K.9.3 RECYCLING PROJECT
K.9.4 MAKING PAPER

CLUSTER 10 MATTER, SPACE, AND CONSTRUCTION

K.10.1 CUBBY ORGANIZATION
K.10.2 PATTERNS IN PUZZLES
K.10.3 MAKING ENVELOPES
K.10.4 MAKING PUZZLES
K.10.5 MAKING BOXES AND BAGS
K.10.6 VOLUME OF BOXES AND BAGS
K.10.7 PACKING AND STORING
K.10.8 LINEAR MEASUREMENT

DASH 1
ACTIVITY LIST

CLUSTER 1 LEARNING

1.1.1 THE LEARNING CALENDAR
1.1.2 THE RESPONSIBILITY CHART
1.1.3 THE PLANNING CALENDAR
1.1.4 THING LEARNED LAST YEAR
1.1.5 HELPING
1.1.6 WORKING TOGETHER
1.1.7 TAKING TURNS AND SHARING
1.1.8 CONCEPT AND SKILL INVENTORY

CLUSTER 2 TIME, WEATHER, AND SKY

1.2.1 SKY AND WEATHER WATCH
1.2.2 RAIN AND STREAMS
1.2.3 SNOW AND STREAMS
1.2.4 THE DIGITAL CLOCK
1.2.5 HOURS AND MINUTES
1.2.6 TIME LINE
1.2.7 SUNRISE AND SUNSET
1.2.8 NIGHT AND DAY
1.2.9 THE SUN
1.2.10 THE SEASONS
1.2.11 MAKING A CLOCK
1.2.12 MOONRISE AND MOON SET

CLUSTER 3 ANIMALS

1.3.1 LIVING AND NON-LIVING THINGS
1.3.2 DEFINING LIVING AND NON-LIVING THINGS
1.3.3 ANIMAL SURVEY
1.3.4 ANIMAL KEY
1.3.5 ANIMAL NEEDS
1.3.6 PLANNING TO RAISE A SMALL ANIMAL
1.3.7 BUILDING CAGES
1.3.8 METAMORPHOSIS
1.3.9 CLASSROOM PETS

CLUSTER 4 PLANTS

1.4.1 PLANT IDENTIFICATION
1.4.2 PLANT SURVEY
1.4.3 PLANT PRESSING
1.4.4 PLANT KEY
1.4.5 PLANT NEEDS
1.4.6 PLANT LIFE CYCLE
1.4.7 EDIBLE PLANT PARTS
1.4.8 PLANT PARTS ANIMALS EAT

CLUSTER 5 FOOD AND NUTRITION

1.5.1 BASIC THREE FOOD GROUPS
1.5.2 COOKING
1.5.3 MEASURING VOLUME

CLUSTER 6 HEALTH AND SAFETY

1.6.1 GROWTH CHART
1.6.2 TOOTH CHART
1.6.3 BRUSHING TEETH
1.6.4 CHEWING
1.6.5 AIR AND BREATHING
1.6.6 GETTING HURT
1.6.7 STAYING HEALTHY
1.6.8 SAFETY RULES

CLUSTER 7 WAYFINDING AND TRANSPORTATION

1.7.1 PACING
1.7.2 NORTH, SOUTH, EAST, AND WEST
1.7.3 HOME
1.7.4 MAP DISTANCE
1.7.5 MAKING A BOAT
1.7.6 MAKING A LAKE
1.7.7 THE GREAT REGATTA
1.7.8 FLOATING AND SINKING
1.7.9 DRAINING A LAKE

CLUSTER 8 ENERGY AND COMMUNICATION

1.8.1 TEMPERATURE OF THINGS
1.8.2 THE MASTER THERMOMETER
1.8.3 HOT AND COLD
1.8.4 SOURCES OF ENERGY

CLUSTER 9 CONSERVATION, RECYCLING, AND DECOMPOSITION

1.9.1 CONSERVING CLASSROOM RESOURCES
1.9.2 CONSERVING ENERGY
1.9.3 CONSERVING WATER
1.9.4 DECOMPOSITION AND UNEARTHING
1.9.5 DECOMPOSITION AND REBURIAL
1.9.6 RECYCLING

CLUSTER 10 MATTER, SPACE, AND CONSTRUCTION

1.10.1 METER–STRING CAN
1.10.2 OUTDOOR STUDY AREA MAPPING
1.10.3 TESTING FOR WATER
1.10.4 PLUMBING
1.10.5 WATER SYSTEMS
1.10.6 AIR
1.10.7 BUBBLES IN WATER
1.10.8 BUBBLES IN AIR
1.10.9 BUILDING WITH AIR
1.10.10 FLOOR PLAN
1.10.11 FLOOR PLAN MODEL
1.10.12 CARDBOARD HOUSE PLAN
1.10.13 MAKING A CARDBOARD HOUSE
1.10.14 PAINTING THE HOUSE
1.10.15 FURNISHING THE HOUSE
1.10.16 SEWING
1.10.17 WEAVING
1.10.18 WARMING AND COOLING THE HOUSE
1.10.19 LIGHTING THE HOUSE
1.10.20 SAFETY EQUIPMENT

DASH 2
ACTIVITY LIST

CLUSTER 1 LEARNING

2.1.1 THE LEARNING CALENDAR
2.1.2 LAST YEAR
2.1.3 APHORISMS
2.1.4 HELPING MYSELF AND OTHERS
2.1.5 GETTING HELP
2.1.6 MAKING AND KEEPING FRIENDS
2.1.7 TURNS
2.1.8 SCHOOL, TEACHER, FRIENDS, AND FAMILY
2.1.9 PREDICTIONS ABOUT TOMORROW
2.1.10 PLANNING FOR TOMORROW
2.1.11 THINKING
2.1.12 LIBRARY
2.1.13 CONCEPT AND SKILL INVENTORY

CLUSTER 2 TIME, WEATHER, AND SKY

2.2.1 TEMPERATURE
2.2.2 WIND
2.2.3 SUNRISE, SUNSET, AND SEASONS
2.2.4 MOONRISE AND MOONSET
2.2.5 RAIN
2.2.6 SNOW
2.2.7 DIGITAL TIME
2.2.8 ANALOG TIME

CLUSTER 3 ANIMALS

2.3.1 THE CLASSROOM AQUARIUM
2.3.2 EXTERNAL ANATOMY OF FISH
2.3.3 BIOLOGICAL NEEDS OF FISH
2.3.4 REPRODUCTION AND DEVELOPMENT OF FISH
2.3.5 FINDING INSECT EGGS
2.3.6 HATCHING INSECT EGGS
2.3.7 EARLY METAMORPHOSIS
2.3.8 LATE METAMORPHOSIS
2.3.9 COLLECTING SPIDERS
2.3.10 SPIDER FOOD
2.3.11 SPIDER CARE
2.3.12 SPIDERS AS PREDATORS
2.3.13 SPIDER WEBS
2.3.14 CLASSROOM PETS

CLUSTER 4 PLANTS

2.4.1 SOIL
2.4.2 MAKING SOIL
2.4.3 SOIL AND PLANTS
2.4.4 SOIL USES
2.4.5 FINDING SOIL
2.4.6 PIPES AND WATER
2.4.7 MOVING WATER
2.4.8 MOVING WATER WITH PUMPS
2.4.9 VEGETABLE GARDEN IN A BUCKET
2.4.10 FLOWER GARDEN IN A BUCKET
2.4.11 PLANTS AND SUNLIGHT
2.4.12 ROOTING STEMS
2.4.13 ROOTING BULBS AND TUBERS
2.4.14 ROOTS AND WATER
2.4.15 GROWING ROOT VEGETABLES
2.4.16 TREE PLANTING

CLUSTER 5 FOOD AND NUTRITION

2.5.1 SUPERMARKET SURVEY
2.5.2 FOOD PREFERENCES
2.5.3 BASIC THREE FOOD GROUPS
2.5.4 NEW FOODS
2.5.5 IDENTIFYING PROPERTIES OF VEGETABLES
2.5.6 CHANGING FLAVOR
2.5.7 MILK
2.5.8 BUTTER
2.5.9 CHEESE
2.5.10 ENERGY FROM FOOD

CLUSTER 6 HEALTH AND SAFETY

2.6.1 GROWTH CHART
2.6.2 TOOTH CHART
2.6.3 TOOTH CARE
2.6.4 GETTING HURT
2.6.5 GETTING SICK
2.6.6 STAYING WELL
2.6.7 CLASSROOM AND PLAYGROUND SAFETY
2.6.8 FIRE SAFETY
2.6.9 USING 911

CLUSTER 7 WAYFINDING AND TRANSPORTATION

2.7.1 TRANSPORTATION SYSTEMS
2.7.2 MAKING RACE CARS
2.7.3 RACING AND MODIFYING CARS
2.7.4 ROADS
2.7.5 BUILDING A VILLAGE
2.7.6 PEDESTRIANS IN THE VILLAGE
2.7.7 BIKES IN THE VILLAGE
2.7.8 CARS IN THE VILLAGE
2.7.9 BIKES AND TRIKES
2.7.10 BELTS AND PULLEYS
2.7.11 FAST AND SLOW PULLEYS
2.7.12 GEARS AND WHEELS

CLUSTER 8 ENERGY AND COMMUNICATION

2.8.1 CAMERA OBSCURA
2.8.2 MIRRORS AND SUNLIGHT
2.8.3 CLOUDS AND SUNLIGHT
2.8.4 COMPARING TEMPERATURES
2.8.5 ECLIPSES

CLUSTER 9 CONSERVATION, RECYCLING, AND DECOMPOSITION

2.9.1 FALL UNEARTHING
2.9.2 FALL BURYING
2.9.3 SPRING UNEARTHING
2.9.4 SPRING BURYING
2.9.5 POLLUTION SURVEY AND CLEANUP
2.9.6 ALUMINUM RECYCLING
2.9.7 CONNECTIONS

CLUSTER 10 MATTER, SPACE, AND CONSTRUCTION

2.10.1 DESK ORGANIZATION
2.10.2 NOTEBOOK ORGANIZATION
2.10.3 THE BALANCE
2.10.4 METER-STRING CAN
2.10.5 MEASURING VOLUME
2.10.6 SAFETY EQUIPMENT

DASH 3
ACTIVITY LIST

CLUSTER 1 LEARNING

3.1.1 THE LEARNING CALENDAR
3.1.2 LAST YEAR
3.1.3 RESPONSIBILITY
3.1.4 PLANNING
3.1.5 ORGANIZING OUR ENVIRONMENT
3.1.6 FRIENDS
3.1.7 GIVING AND RECEIVING
3.1.8 WORKING TOGETHER
3.1.9 HELPING MYSELF AND OTHERS
3.1.10 APHORISMS
3.1.11 NEXT YEAR
3.1.12 CAREY'S GARDEN
3.1.13 CONCEPT AND SKILL INVENTORY

CLUSTER 2 TIME, WEATHER, AND SKY

3.2.1 WEATHER
3.2.2 TEMPERATURE
3.2.4 WIND
3.2.5 RAIN AND SNOW
3.2.6 HUMIDITY
3.2.7 MOON PHASES
3.2.8 POLAR SKY MODEL
3.2.9 POLAR CONSTELLATIONS
3.2.10 VENUS
3.2.11 ECLIPSES

CLUSTER 3 ANIMALS

3.3.1 CLASSROOM PETS
3.3.2 PREPARING TO RAISE INSECTS
3.3.3 RAISING INSECTS
3.3.4 IMPORTANCE OF INSECTS
3.3.5 NATURAL HABITATS OF FROGS AND TOADS
3.3.6 MAKING HABITATS FOR FROGS AND TOADS
3.3.7 FROG METAMORPHOSIS
3.3.8 IMPORTANCE OF FROGS AND TOADS
3.3.9 TOADS AND INSECTS
3.3.10 HATCHING CHICKS
3.3.11 CHICK GROWTH
3.3.12 IMPORTANCE OF BIRDS

CLUSTER 4 PLANTS

3.4.1 GARDEN PLANNING
3.4.2 GARDEN PREPARATION
3.4.3 WATCHING GARDEN SOIL
3.4.4 MAKING ARTIFICIAL SOIL
3.4.5 TESTING ARTIFICIAL SOIL
3.4.6 SOIL AND WATER
3.4.7 GARDEN PLANTING
3.4.8 GARDEN CARE
3.4.9 GARDEN WATERING SYSTEMS
3.4.10 GARDEN INVADERS
3.4.11 CONTROLLING INSECTS
3.4.12 GARDEN HARVESTING
3.4.13 FLOWERS
3.4.14 SEEDS
3.4.15 POLLINATION

CLUSTER 5 FOOD AND NUTRITION

3.5.1 FOOD SELECTION
3.5.2 SELECTING PLANTS FOR THE GARDEN
3.5.3 PLANNING THE CLASS FEAST
3.5.4 PREPARING THE CLASS FEAST
3.5.5 THE CLASS FEAST
3.5.6 DRYING FOODS
3.5.7 PICKLING FOODS
3.5.8 PRESERVING AND ROTTING
3.5.9 SUPERMARKET GAME PREPARATION
3.5.10 PRICING FOODS
3.5.11 NEWSPAPER ADS AND BANKING
3.5.12 FARMERS AND PROCESSORS
3.5.13 SUPERMARKET GAME

CLUSTER 6 HEALTH AND SAFETY

3.6.1 GROWTH CHART
3.6.2 TOOTH CHART
3.6.3 BREATHING AIR
3.6.4 ANATOMY OF BREATHING
3.6.5 LUNG MODEL
3.6.6 LUNGS AND SMOKING
3.6.7 BREATHING AND PULSE RATES
3.6.8 HEART, VEINS, AND ARTERIES
3.6.9 HEART, LUNGS, AND EXERCISE
3.6.10 DISEASE TRANSMISSION
3.6.11 TRASH AND SANITATION
3.6.12 HELPFUL DRUGS
3.6.13 PROPER DRUG USE

CLUSTER 7 WAYFINDING AND TRANSPORTATION

3.7.1 GARDEN MOVER
3.7.2 PROPELLER-DRIVEN MESSAGE CENTER
3.7.3 PROPELLER-DRIVEN BOAT
3.7.4 DELIVERY SYSTEMS

CLUSTER 8 ENERGY AND COMMUNICATION

3.8.1 SHADOW, LIGHT, AND BUBBLES
3.8.2 WIND AND HEAT
3.8.3 WIND PULLS AND PUSHES
3.8.4 PROPELLERS DRIVING PROPELLERS
3.8.5 WATERWHEELS
3.8.6 PROPELLERS IN WATER
3.8.7 HELIOGRAPH
3.8.8 SPEAKING TUBE
3.8.9 STRING TELEPHONE
3.8.10 ENERGY DEFINITIONS

CLUSTER 9 CONSERVATION, RECYCLING, AND DECOMPOSITION

3.9.1 MAKING COMPOST
3.9.2 WATCHING COMPOST
3.9.3 ANIMALS IN COMPOST
3.9.4 USING COMPOST
3.9.5 FALL UNEARTHING AND BURIAL
3.9.6 SPRING UNEARTHING AND BURIAL

CLUSTER 10 MATTER, SPACE, AND CONSTRUCTION

3.10.1 ACIDIC AND BASIC SOIL
3.10.2 ACIDS AND BASES
3.10.3 ACID AND BASE REACTIONS
3.10.4 DILUTING ACIDS AND BASES
3.10.5 ACID AND BASE INTERACTION
3.10.6 DISSOLVING THINGS
3.10.7 THINGS IN LIQUIDS
3.10.8 CRYSTALS
3.10.9 RAIN IN A JAR
3.10.10 SUPERMARKET PLANNING
3.10.11 SUPERMARKET CONSTRUCTION
3.10.12 MEASURING DEVICES
3.10.13 SAFETY EQUIPMENT

DASH 4
ACTIVITY LIST

CLUSTER 1 LEARNING

4.1.1 THE LEARNING CALENDAR
4.1.2 RESPONSIBILITY
4.1.3 LAST YEAR
4.1.4 THE LIBRARY
4.1.5 WORKING TOGETHER
4.1.6 THINGS I CAN DO FOR MYSELF AND FOR OTHERS
4.1.7 APHORISMS
4.1.8 PLANNING
4.1.9 SURVIVAL GAME
4.1.10 CONCEPT AND SKILL INVENTORY

CLUSTER 2 TIME, WEATHER, AND SKY

4.2.1 RAINFALL
4.2.2 SNOWFALL
4.2.3 WIND DIRECTION
4.2.4 WIND SPEED
4.2.5 HEIGHT OF CLOUDS
4.2.6 HUMIDITY
4.2.7 CLOUDS AND WEATHER
4.2.8 STORM CLOUDS
4.2.9 LIGHTNING
4.2.10 WEATHER MAPS
4.2.11 WEATHER FRONTS
4.2.12 PREDICTING WEATHER
4.2.13 WIND CHILL
4.2.14 FLAT OR ROUND EARTH
4.2.15 LENGTH OF DAY AND NIGHT
4.2.16 THE SUN'S SHADOW PATH
4.2.17 PLANETARIUM
4.2.18 USING THE PLANETARIUM
4.2.19 PLANETS
4.2.20 WHEN IS IT NOON?
4.2.21 MAKING A SUNDIAL
4.2.22 USING A SUNDIAL
4.2.23 SEASONS AND THE SUN
4.2.24 MOON PHASES AND THE SUN
4.2.25 ECLIPSES

CLUSTER 3 ANIMALS

4.3.1 PET CARE
4.3.2 THE UNINCUBATED EGG
4.3.3 CHICK EMBRYOLOGY
4.3.4 RAISING SMALL MAMMALS
4.3.5 HOUSING PET MAMMALS
4.3.6 WEEKEND CARE OF PET MAMMALS
4.3.7 PAIRING PET MAMMALS
4.3.8 REPRODUCTION OF PET MAMMALS
4.3.9 PET BABY CARE
4.3.10 OUR EARLY YEARS
4.3.11 THE FIRST GRADE CHILD
4.3.12 GROWTH, DEVELOPMENT, AND BEHAVIOR OF YOUNG PETS
4.3.13 HUMAN GROWTH AND DEVELOPMENT
4.3.14 CHANGING DIMENSIONS
4.3.15 EXTERNAL ANATOMY OF FISH
4.3.16 CLEANING FISH: INTERNAL ANATOMY
4.3.17 FISH REPRODUCTION
4.3.18 MODELING OUR DIGESTIVE SYSTEM
4.3.19 OUR DIGESTIVE SYSTEM IN TWO DIMENSIONS
4.3.20 DIGESTIVE, CIRCULATORY, AND RESPIRATORY SYSTEMS
4.3.21 LENGTH OF THE DIGESTIVE TRACT
4.3.22 MIGRATION AND HIBERNATION
4.3.23 FALL BIRDS
4.3.24 WINTER BIRDS
4.3.25 SPRING BIRDS

CLUSTER 4 PLANTS

4.4.1 ANNUAL, BIENNIAL, AND PERENNIAL GARDEN PLANTS
4.4.2 THE FUNGUS AMONG US
4.4.3 FUNGUS COLLECTION

CLUSTER 5 FOOD AND NUTRITION

4.5.1 NUTRITION MESSAGES
4.5.2 MECHANICAL DIGESTION
4.5.3 CHEMICAL DIGESTION
4.5.4 FOOD GROUPS
4.5.5 DIGESTION GAME
4.5.6 PRESERVING FOODS

CLUSTER 6 HEALTH AND SAFETY

4.6.1 GROWTH CHART AND AREA MEASUREMENT
4.6.2 TOOTH CHART
4.6.3 SAFETY GEAR
4.6.4 SAFETY AND PUTTING OUT FIRES
4.6.5 MAKING A FIRE
4.6.6 THINGS THAT BURN
4.6.7 SMOKING AND THE LUNGS
4.6.8 ALCOHOL, TOBACCO, AND DRUGS

CLUSTER 7 WAYFINDING AND TRANSPORTATION

4.7.1 BOAT DESIGN
4.7.2 WIND AND SAILS

CLUSTER 8 ENERGY AND COMMUNICATION

4.8.1 PUSH-PULL MEASURING TOOL
4.8.2 FRICTION
4.8.3 STREAMLINING
4.8.4 PRESSURE, SHARP EDGES, AND POINTS
4.8.5 ENERGY OF FALLING OBJECTS
4.8.6 CIRCLES AND SPEED

CLUSTER 9 CONSERVATION, RECYCLING, AND DECOMPOSITION

4.9.1 UNEARTHING
4.9.2 RECYCLING PROJECT

CLUSTER 10 MATTER, SPACE, AND CONSTRUCTION

4.10.1 LINEAR MEASUREMENT
4.10.2 VOLUME MEASUREMENT
4.10.3 MASS MEASUREMENT
4.10.4 COLLECTING ROCKS
4.10.5 HARDNESS OF ROCKS
4.10.6 SPECIFIC GRAVITY
4.10.7 ROCKS AND SHARP EDGES
4.10.8 MAKING TOOLS FROM ROCK
4.10.9 MAKING FISHING TOOLS
4.10.10 CLOWNS: THINGS THAT FLOAT
4.10.11 CLAY
4.10.12 FIRE AND POTTERY
4.10.13 AIR AND FIRE
4.10.14 FIRE AND OXYGEN
4.10.15 PROPERTIES OF GASES

BEST COPY AVAILABLE

DASH 5
ACTIVITY LIST

CLUSTER 1 LEARNING

5.1.1	THE LEARNING CALENDAR
5.1.2	RESPONSIBILITY
5.1.3	LIBRARY CHECK-OUT
5.1.4	LIBRARY CHECK-IN
5.1.5	WORKING TOGETHER
5.1.6	THINGS I CAN DO FOR MYSELF AND OTHERS
5.1.7	APHORISMS
5.1.8	FRIENDSHIP
5.1.9	CONCEPT AND SKILL INVENTORY

CLUSTER 2 TIME, WEATHER, AND SKY

5.2.1	WEATHER STATION
5.2.2	HEAT INDEX
5.2.3	WEATHER AND ITS PREDICTION
5.2.4	CLOUDS AND FRONTS
5.2.5	TRIANGLES
5.2.6	GNOMON
5.2.7	SIZE OF THE EARTH
5.2.8	MOON THROUGH A TELESCOPE
5.2.9	HOW BIG AND FAR AWAY IS THE MOON?
5.2.10	PATHS OF CELESTIAL BODIES
5.2.11	MODELS OF THE SOLAR SYSTEM

CLUSTER 3 ANIMALS

5.3.1	PET CARE
5.3.2	BIRD FEEDER
5.3.3	BIRDS I KNOW
5.3.4	CELLS
5.3.5	CELL QUIZ
5.3.6	MALE UROGENITAL SYSTEM
5.3.7	FEMALE UROGENITAL SYSTEM
5.3.8	OVULATION CYCLE
5.3.9	OVULATION AND PREGNANCY
5.3.10	EMBRYOLOGY
5.3.11	BODY CHANGES
5.3.12	BONES
5.3.13	SKELETAL SYSTEM
5.3.14	MUSCLES
5.3.15	MUSCULAR SYSTEM
5.3.16	CHEMISTRY AND BONES
5.3.17	THE SENSES
5.3.18	THE EYE
5.3.19	SOUND
5.3.20	THE EAR

CLUSTER 4 PLANTS

5.4.1	ANNUAL, BIENNIAL, AND PERENNIAL PLANT PROJECT
5.4.2	TREE HARVESTING
5.4.3	TREE PLANTING
5.4.4	TREE OBSERVATION
5.4.5	MEASURING TREES
5.4.6	AGE OF TREES
5.4.7	TREES, SHRUBS, AND GRASSES
5.4.8	GRASSES: WHY DO THEY GROW THERE?
5.4.9	ROOTS
5.4.10	SOIL CONSERVATION

CLUSTER 5 FOOD AND NUTRITION

5.5.1	NUTRIENTS
5.5.2	NUTRIENTS AND CELLS
5.5.3	FOOD LABELING

CLUSTER 6 HEALTH AND SAFETY

5.6.1	GROWTH CHART AND AREA MEASUREMENT
5.6.2	TOOTH CHART
5.6.3	SAFETY DEVICES
5.6.4	ALCOHOL, TOBACCO, AND DRUGS
5.6.5	SEXUALLY TRANSMITTED DISEASES
5.6.6	SEXUALLY TRANSMITTED DISEASE QUIZ
5.6.7	TOBACCO QUIZ
5.6.8	SMOKERS' SURVEY
5.6.9	EX-SMOKERS' SURVEY
5.6.10	SMOKING LAWS
5.6.11	ALCOHOL QUIZ
5.6.12	ALCOHOL LAWS
5.6.13	CHRIS'S STORY
5.6.14	THE PARENTS' STORY
5.6.15	INTOXICATION
5.6.16	DRUG LAWS

CLUSTER 7 WAYFINDING AND TRANSPORTATION

5.7.1	WHERE IN THE WORLD ARE WE?
5.7.2	PLANETARIUM
5.7.3	MAPPING THE SKY
5.7.4	THE NORTH POLE, EQUATOR, AND ECLIPTIC
5.7.5	WHERE IS EARTH?

CLUSTER 8 ENERGY AND COMMUNICATION

5.8.1	PUSHES, PULLS, AND FORCES
5.8.2	TEETER-TOTTERS
5.8.3	THE BALANCE
5.8.4	WHEELS AND AXLES
5.8.5	LEVERS: WHERE ARE THEY?
5.8.6	ARMS AND JAWS
5.8.7	INCLINED PLANES AND SCREWS
5.8.8	BLOCK AND TACKLE
5.8.9	FORCES PROJECTS

CLUSTER 9 CONSERVATION, RECYCLING, AND DECOMPOSITION

5.9.1	CLASS RECYCLING PROJECT
5.9.2	CLASS CONSERVATION PROJECT
5.9.3	DECOMPOSITION AND ARCHEOLOGY
5.9.4	POLLUTION PROJECT

CLUSTER 10 MATTER, SPACE, AND CONSTRUCTION

5.10.1	LINEAR MEASUREMENT
5.10.2	VOLUME MEASUREMENT
5.10.3	CAMERA OBSCURA
5.10.4	CONTROLLING LIGHT WITH LENSES
5.10.5	MAKING A TELESCOPE
5.10.6	STABILIZING THE TELESCOPE
5.10.7	MAKING A MICROSCOPE
5.10.8	MAKING A HYGROMETER
5.10.9	MAKING A BAROMETER

DASH 6
ACTIVITY LIST

CLUSTER 1 LEARNING

6.1.1 THE LEARNING CALENDAR
6.1.2 MARS MISSION
6.1.3 LAST YEAR
6.1.4 TOMORROW
6.1.5 THE WORK WORLD
6.1.6 GOALS
6.1.7 CRASH SIMULATION
6.1.8 MARS COMPACT
6.1.9 MARTIAN SIMULATION
6.1.10 THE MISSION CONFERENCE
6.1.11 CONCEPT AND SKILL INVENTORY

CLUSTER 2 TIME, WEATHER, AND SKY

6.2.1 WEATHER STATION
6.2.2 WEATHER AROUND THE UNITED STATES
6.2.3 WEATHER AND LOCAL CLIMATE
6.2.4 WIND HYPOTHESES
6.2.5 PRODUCING WINDS
6.2.6 AIR PRESSURE AND ALTITUDE
6.2.7 WIND AND WATER
6.2.8 ALTITUDE AND TEMPERATURE
6.2.9 MODELS OF AIR
6.2.10 CLIMATIC REGIONS
6.2.11 CLIMATE OF MARS

CLUSTER 3 ANIMALS

6.3.1 ANIMAL CARE
6.3.2 RAISING FISH
6.3.3 RAISING WORMS
6.3.4 FOOD CHAINS

CLUSTER 4 PLANTS

6.4.1 HYDROPONICS
6.4.2 ALGAE
6.4.3 NUTRIENTS AND BIOLOGICAL WASTE
6.4.4 WATER POLLUTANTS

CLUSTER 5 FOOD AND NUTRITION

6.5.1 NUTRIENT INFORMATION
6.5.2 THE KILOCALORIE
6.5.3 WEIGHT WATCHING
6.5.4 MEAL PLANNING
6.5.5 FOOD FOR SPACE
6.5.6 FISH FOR DINNER

CLUSTER 6 HEALTH AND SAFETY

6.6.1 GROWTH CHART
6.6.2 TOOTH CHART
6.6.3 SAFETY DEVICES
6.6.4 DISEASE LITERATURE
6.6.5 SANITATION
6.6.6 DISEASE-PRODUCING ORGANISMS
6.6.7 SEXUALLY TRANSMITTED DISEASES
6.6.8 DRUG ABUSE: PREVENTION AND TREATMENT
6.6.9 ALCOHOL AND TOBACCO
6.6.10 ENVIRONMENTAL DISEASE: TRANSMISSION, PREVENTION, AND TREATMENT
6.6.11 EXERCISE AND HEALTH AND THE MARS MISSION

CLUSTER 7 WAYFINDING AND TRANSPORTATION

6.7.1 FLYING AIRPLANES
FLYING ROCKETS
6.7.3 SPACECRAFT
6.7.4 THE ORBIT OF MARS
6.7.5 WHAT PATH TO MARS?

CLUSTER 8 ENERGY AND COMMUNICATION

6.8.1 ROCKET PROPULSION
6.8.2 MAGNETISM
6.8.3 ELECTROSTATICS
6.8.4 ELECTRICAL CIRCUITS
6.8.5 ROCK FORMATION
6.8.6 METALS FROM ROCK
6.8.7 ASYMMETRICAL LEVER

CLUSTER 9 CONSERVATION, RECYCLING, AND DECOMPOSITION

6.9.1 CLASS RECYCLING PROJECT
6.9.2 CONSERVATION
6.9.3 DECOMPOSITION: A SUMMARY
6.9.4 POLLUTION

CLUSTER 10 MATTER, SPACE, AND CONSTRUCTION

6.10.1 MAKING MEASURING EQUIPMENT
6.10.2 MAKING BALANCES
6.10.3 MAKING AN ELECTROSCOPE
6.10.4 MAKING ELECTROMAGNETS AND CURRENT INDICATORS
6.10.5 MAKING ELECTRIC CELLS
6.10.6 MAKING AN ELECTRIC MOTOR
6.10.7 MAKING AN ELECTRIC SIGNALER
6.10.8 MAKING A SURVIVAL HABITAT

DASH K-6
CLUSTER OUTLINES

CLUSTER ONE - LEARNING

GRADE KINDERGARTEN

K.1.1	THE LEARNING CALENDAR
K.1.2	THE HOME LEARNING CALENDAR
K.1.3	CALENDAR REVIEW
K.1.4	RESPONSIBILITY
K.1.5	THE SCIENCE RECORD BOOK
K.1.6	USING OUR SENSES
K.1.7	SAME AND DIFFERENT
K.1.8	PHYSICAL CHARACTERISTICS OF THINGS
K.1.9	FUNCTIONS OF THINGS
K.1.10	THE WORKING DICTIONARY AND WORKING DEFINITIONS
K.1.11	THE WONDER AND DISCOVER BOOK
K.1.12	THE CONNECTIONS BOOK
K.1.13	FAMILIES
K.1.14	FAMILIES AND HELPING
K.1.15	MAKING FRIENDS
K.1.16	BEING FRIENDS
K.1.17	SCHOOL AND HOME
K.1.18	CONCEPT AND SKILL INVENTORY

GRADE ONE

1.1.1	THE LEARNING CALENDAR
1.1.2	THE RESPONSIBILITY CHART
1.1.3	THE PLANNING CALENDAR
1.1.4	THING LEARNED LAST YEAR
1.1.5	HELPING
1.1.6	WORKING TOGETHER
1.1.7	TAKING TURNS AND SHARING
1.1.8	CONCEPT AND SKILL INVENTORY

GRADE TWO

2.1.1	THE LEARNING CALENDAR
2.1.2	LAST YEAR
2.1.3	APHORISMS
2.1.4	HELPING MYSELF AND OTHERS
2.1.5	GETTING HELP
2.1.6	MAKING AND KEEPING FRIENDS
2.1.7	TURNS
2.1.8	SCHOOL, TEACHER, FRIENDS, AND FAMILY
2.1.9	PREDICTIONS ABOUT TOMORROW
2.1.10	PLANNING FOR TOMORROW
2.1.11	THINKING
2.1.12	LIBRARY
2.1.13	CONCEPT AND SKILL INVENTORY

GRADE THREE

3.1.1	THE LEARNING CALENDAR
3.1.2	LAST YEAR
3.1.3	RESPONSIBILITY
3.1.4	PLANNING
3.1.5	ORGANIZING OUR ENVIRONMENT
3.1.6	FRIENDS
3.1.7	GIVING AND RECEIVING
3.1.8	WORKING TOGETHER
3.1.9	HELPING MYSELF AND OTHERS
3.1.10	APHORISMS
3.1.11	NEXT YEAR
3.1.12	CAREY'S GARDEN
3.1.13	CONCEPT AND SKILL INVENTORY

GRADE FOUR

4.1.1	THE LEARNING CALENDAR
4.1.2	RESPONSIBILITY
4.1.3	LAST YEAR
4.1.4	THE LIBRARY
4.1.5	WORKING TOGETHER
4.1.6	THINGS I CAN DO FOR MYSELF AND FOR OTHERS
4.1.7	APHORISMS
4.1.8	PLANNING
4.1.9	SURVIVAL GAME
4.1.10	CONCEPT AND SKILL INVENTORY

GRADE FIVE

5.1.1	THE LEARNING CALENDAR
5.1.2	RESPONSIBILITY
5.1.3	LIBRARY CHECK-OUT
5.1.4	LIBRARY CHECK-IN
5.1.5	WORKING TOGETHER
5.1.6	THINGS I CAN DO FOR MYSELF AND OTHERS
5.1.7	APHORISMS
5.1.8	FRIENDSHIP
5.1.9	CONCEPT AND SKILL INVENTORY

GRADE SIX

6.1.1	THE LEARNING CALENDAR
6.1.2	MARS MISSION
6.1.3	LAST YEAR
6.1.4	TOMORROW
6.1.5	THE WORK WORLD
6.1.6	GOALS
6.1.7	CRASH SIMULATION
6.1.8	MARS COMPACT
6.1.9	MARTIAN SIMULATION
6.1.10	THE MISSION CONFERENCE
6.1.11	CONCEPT AND SKILL INVENTORY

CLUSTER TWO - TIME, WEATHER, AND SKY

GRADE KINDERGARTEN

K.2.1	WEATHER WATCH
K.2.2	BEGINNINGS
K.2.3	ENDINGS
K.2.4	DAY AND NIGHT
K.2.5	DAYS, WEEKS, AND MONTHS
K.2.6	MOON WATCH
K.2.7	MOON PHASES
K.2.8	SEASONS
K.2.9	CLOCKS AND CALENDARS

GRADE ONE

1.2.1	SKY AND WEATHER WATCH
1.2.2	RAIN AND STREAMS
1.2.3	SNOW AND STREAMS
1.2.4	THE DIGITAL CLOCK
1.2.5	HOURS AND MINUTES
1.2.6	TIME LINE
1.2.7	SUNRISE AND SUNSET
1.2.8	NIGHT AND DAY
1.2.9	THE SUN
1.2.10	THE SEASONS
1.2.11	MAKING A CLOCK
1.2.12	MOONRISE AND MOON SET

GRADE TWO

2.2.1	TEMPERATURE
2.2.2	WIND
2.2.3	SUNRISE, SUNSET, AND SEASONS
2.2.4	MOONRISE AND MOONSET
2.2.5	RAIN
2.2.6	SNOW
2.2.7	DIGITAL TIME
2.2.8	ANALOG TIME

GRADE THREE

3.2.1	WEATHER
3.2.2	TEMPERATURE
3.2.3	WIND
3.2.4	RAIN AND SNOW
3.2.5	HUMIDITY
3.2.6	SUNRISE AND SUNSET
3.2.7	MOON PHASES
3.2.8	POLAR SKY MODEL
3.2.9	POLAR CONSTELLATIONS
3.2.10	VENUS
3.2.11	ECLIPSES

GRADE FOUR

4.2.1	RAINFALL
4.2.2	SNOWFALL
4.2.3	WIND DIRECTION
4.2.4	WIND SPEED
4.2.5	HEIGHT OF CLOUDS
4.2.6	HUMIDITY
4.2.7	CLOUDS AND WEATHER
4.2.8	STORM CLOUDS
4.2.9	LIGHTNING
4.2.10	WEATHER MAPS
4.2.11	WEATHER FRONTS
4.2.12	PREDICTING WEATHER
4.2.13	WIND CHILL
4.2.14	FLAT OR ROUND EARTH
4.2.15	LENGTH OF DAY AND NIGHT
4.2.16	THE SUN'S SHADOW PATH
4.2.17	PLANETARIUM
4.2.18	USING THE PLANETARIUM
4.2.19	PLANETS
4.2.20	WHEN IS IT NOON?
4.2.21	MAKING A SUNDIAL
4.2.22	USING A SUNDIAL
4.2.23	SEASONS AND THE SUN
4.2.24	MOON PHASES AND THE SUN
4.2.25	ECLIPSES

GRADE FIVE

5.2.1	WEATHER STATION
5.2.2	HEAT INDEX
5.2.3	WEATHER AND ITS PREDICTION
5.2.4	CLOUDS AND FRONTS
5.2.5	TRIANGLES
5.2.6	GNOMON
5.2.7	SIZE OF EARTH
5.2.8	MOON THROUGH A TELESCOPE
5.2.9	HOW BIG AND FAR AWAY IS THE MOON?
5.2.10	PATHS OF CELESTIAL BODIES
5.2.11	MODELS OF THE SOLAR SYSTEM

GRADE SIX

6.2.1	WEATHER STATION
6.2.2	WEATHER AROUND THE UNITED STATES
6.2.3	WEATHER AND LOCAL CLIMATE
6.2.4	WIND HYPOTHESES
6.2.5	PRODUCING WINDS
6.2.6	AIR PRESSURE AND ALTITUDE
6.2.7	WIND AND WATER
6.2.8	ALTITUDE AND TEMPERATURE
6.2.9	MODELS OF AIR
6.2.10	CLIMATIC REGIONS
6.2.11	CLIMATE OF MARS

CLUSTER THREE - ANIMALS

GRADE KINDERGARTEN

K.3.1 APPROPRIATE PETS
K.3.2 CLASSROOM ANIMALS
K.3.3 CARING FOR CLASSROOM ANIMALS
K.3.4 LIVING, ONCE-LIVING, AND NOT-LIVING
K.3.5 ANIMALS AND PLANTS
K.3.6 ANIMAL ENVIRONMENTS
K.3.7 USES FOR ANIMALS
K.3.8 HOW BUGS WALK
K.3.9 PARTS OF BUGS
K.3.10 PARTS OF MAMMALS
K.3.11 PEOPLE
K.3.12 ANIMALS AND FOOD
K.3.13 ANIMALS AND WATER
K.3.14 ANIMALS AND AIR
K.3.15 ANIMAL WASTES
K.3.16 HOW ANIMALS KEEP WARM
K.3.17 HOW ANIMALS KEEP COOL
K.3.18 REAL OR IMAGINARY

GRADE ONE

1.3.1 LIVING AND NOT-LIVING THINGS
1.3.2 DEFINING LIVING AND NOT-LIVING THINGS
1.3.3 ANIMAL SURVEY
1.3.4 ANIMAL KEY
1.3.5 ANIMAL NEEDS
1.3.6 PLANNING TO RAISE A SMALL ANIMAL
1.3.7 BUILDING CAGES
1.3.8 METAMORPHOSIS
1.3.9 CLASSROOM PETS

GRADE TWO

2.3.1 THE CLASSROOM AQUARIUM
2.3.2 EXTERNAL ANATOMY OF FISH
2.3.3 BIOLOGICAL NEEDS OF FISH
2.3.4 REPRODUCTION AND DEVELOPMENT OF FISH
2.3.5 FINDING INSECT EGGS
2.3.6 HATCHING INSECT EGGS
2.3.7 EARLY METAMORPHOSIS
2.3.8 LATE METAMORPHOSIS
2.3.9 COLLECTING SPIDERS
2.3.10 SPIDER FOOD
2.3.11 SPIDER CARE
2.3.12 SPIDERS AS PREDATORS
2.3.13 SPIDER WEBS
2.3.14 CLASSROOM PETS

GRADE THREE

3.3.1 CLASSROOM PETS
3.3.2 PREPARING TO RAISE INSECTS
3.3.3 RAISING INSECTS
3.3.4 IMPORTANCE OF INSECTS
3.3.5 NATURAL HABITATS OF FROGS AND TOADS
3.3.6 MAKING HABITATS FOR FROGS AND TOADS
3.3.7 FROG METAMORPHOSIS
3.3.8 IMPORTANCE OF FROGS AND TOADS
3.3.9 TOADS AND INSECTS
3.3.10 HATCHING CHICKS
3.3.11 CHICK GROWTH
3.3.12 IMPORTANCE OF BIRDS

GRADE FOUR

4.3.1 PET CARE
4.3.2 THE UNINCUBATED EGG
4.3.3 CHICK EMBRYOLOGY
4.3.4 RAISING SMALL MAMMALS
4.3.5 HOUSING PET MAMMALS
4.3.6 WEEKEND CARE OF PET MAMMALS
4.3.7 PAIRING PET MAMMALS
4.3.8 REPRODUCTION OF PET MAMMALS
4.3.9 PET BABY CARE
4.3.10 OUR EARLY YEARS
4.3.11 THE FIRST GRADE CHILD
4.3.12 GROWTH, DEVELOPMENT, AND BEHAVIOR OF YOUNG PETS
4.3.13 HUMAN GROWTH AND DEVELOPMENT
4.3.14 CHANGING DIMENSIONS
4.3.15 EXTERNAL ANATOMY OF FISH
4.3.16 CLEANING FISH: INTERNAL ANATOMY
4.3.17 FISH REPRODUCTION
4.3.18 MODELING OUR DIGESTIVE SYSTEM
4.3.19 OUR DIGESTIVE SYSTEM IN TWO DIMENSIONS
4.3.20 DIGESTIVE, CIRCULATORY, AND RESPIRATORY SYSTEMS
4.3.21 LENGTH OF THE DIGESTIVE TRACT
4.3.22 MIGRATION AND HIBERNATION
4.3.23 FALL BIRDS
4.3.24 WINTER BIRDS
4.3.25 SPRING BIRDS

GRADE FIVE

5.3.1 PET CARE
5.3.2 BIRD FEEDER
5.3.3 BIRDS I KNOW
5.3.4 CELLS
5.3.5 CELL QUIZ
5.3.6 MALE UROGENITAL SYSTEM
5.3.7 FEMALE UROGENITAL SYSTEM
5.3.8 OVULATION CYCLE
5.3.9 OVULATION AND PREGNANCY
5.3.10 EMBRYOLOGY
5.3.11 BODY CHANGES
5.3.12 BONES
5.3.13 SKELETAL SYSTEM
5.3.14 MUSCLES
5.3.15 MUSCULAR SYSTEM
5.3.16 CHEMISTRY AND BONES
5.3.17 THE SENSES
5.3.18 THE EYE
5.3.19 SOUND
5.3.20 THE EAR

GRADE SIX

6.3.1 ANIMAL CARE
6.3.2 RAISING FISH
6.3.3 RAISING WORMS
6.3.4 FOOD CHAINS

CLUSTER FOUR - PLANTS

GRADE KINDERGARTEN

K.4.1	PLANT PARTS
K.4.2	PLANT ENVIRONMENTS
K.4.3	PLANT USES
K.4.4	GROWING BEAN SPROUTS
K.4.5	PLANTS AND WATER
K.4.6	GARDENING

GRADE ONE

1.4.1	PLANT IDENTIFICATION
1.4.2	PLANT SURVEY
1.4.3	PLANT PRESSING
1.4.4	PLANT KEY
1.4.5	PLANT NEEDS
1.4.6	PLANT LIFE CYCLE
1.4.7	EDIBLE PLANT PARTS
1.4.8	PLANT PARTS ANIMALS EAT

GRADE TWO

2.4.1	SOIL
2.4.2	MAKING SOIL
2.4.3	SOIL AND PLANTS
2.4.4	SOIL USES
2.4.5	FINDING SOIL
2.4.6	PIPES AND WATER
2.4.7	MOVING WATER
2.4.8	MOVING WATER WITH PUMPS
2.4.9	VEGETABLE GARDEN IN A BUCKET
2.4.10	FLOWER GARDEN IN A BUCKET
2.4.11	PLANTS AND SUNLIGHT
2.4.12	ROOTING STEMS
2.4.13	ROOTING BULBS AND TUBERS
2.4.14	ROOTS AND WATER
2.4.15	GROWING ROOT VEGETABLES
2.4.16	TREE PLANTING

GRADE THREE

3.4.1	GARDEN PLANNING
3.4.2	GARDEN PREPARATION
3.4.3	WATCHING GARDEN SOIL
3.4.4	MAKING ARTIFICIAL SOIL
3.4.5	TESTING ARTIFICIAL SOIL
3.4.6	SOIL AND WATER
3.4.7	GARDEN PLANTING
3.4.8	GARDEN CARE
3.4.9	GARDEN WATERING SYSTEMS
3.4.10	GARDEN INVADERS
3.4.11	CONTROLLING INSECTS
3.4.12	GARDEN HARVESTING
3.4.13	FLOWERS
3.4.14	SEEDS
3.4.15	POLLINATION

GRADE FOUR

4.4.1	ANNUAL, BIENNIAL, AND PERENNIAL GARDEN PLANTS
4.4.2	THE FUNGUS AMONG US
4.4.3	FUNGUS COLLECTION

GRADE FIVE

5.4.1	ANNUAL, BIENNIAL, AND PERENNIAL PLANT PROJECT
5.4.2	TREE HARVESTING
5.4.3	TREE PLANTING
5.4.4	TREE OBSERVATION
5.4.5	MEASURING TREES
5.4.6	AGE OF TREES
5.4.7	TREES, SHRUBS, AND GRASSES
5.4.8	GRASSES: WHY DO THEY GROW THERE?
5.4.9	ROOTS
5.4.10	SOIL CONSERVATION

GRADE SIX

6.4.1	HYDROPONICS
6.4.2	ALGAE
6.4.3	NUTRIENTS AND BIOLOGICAL WASTE
6.4.4	WATER POLLUTANTS

CLUSTER FIVE - FOOD AND NUTRITION

GRADE KINDERGARTEN

K.5.1	BEAN SPROUT SALAD
K.5.2	DRINKS
K.5.3	FLOUR AND BREAD
K.5.4	FAMILIAR FOODS
K.5.5	FAVORITE FOODS
K.5.6	NEW FOODS
K.5.7	SNACKS FROM THE GARDEN

GRADE ONE

1.5.1	BASIC THREE FOOD GROUPS
1.5.2	COOKING
1.5.3	MEASURING VOLUME

GRADE TWO

2.5.1	SUPERMARKET SURVEY
2.5.2	FOOD PREFERENCES
2.5.3	BASIC THREE FOOD GROUPS
2.5.4	NEW FOODS
2.5.5	IDENTIFYING PROPERTIES OF VEGETABLES
2.5.6	CHANGING FLAVOR
2.5.7	MILK
2.5.8	BUTTER
2.5.9	CHEESE
2.5.10	ENERGY FROM FOOD

GRADE THREE

3.5.1	FOOD SELECTION
3.5.2	SELECTING PLANTS FOR THE GARDEN
3.5.3	PLANNING THE CLASS FEAST
3.5.4	PREPARING THE CLASS FEAST
3.5.5	THE CLASS FEAST
3.5.6	DRYING FOODS
3.5.7	PICKLING FOODS
3.5.8	PRESERVING AND ROTTING
3.5.9	SUPERMARKET GAME PREPARATION
3.5.10	PRICING FOODS
3.5.11	NEWSPAPER ADS AND BANKING
3.5.12	FARMERS AND PROCESSORS
3.5.13	SUPERMARKET GAME

GRADE FOUR

4.5.1	NUTRITION MESSAGES
4.5.2	MECHANICAL DIGESTION
4.5.3	CHEMICAL DIGESTION
4.5.4	FOOD GROUPS
4.5.5	DIGESTION GAME
4.5.6	PRESERVING FOODS

GRADE FIVE

5.5.1	NUTRIENTS
5.5.2	NUTRIENTS AND CELLS
5.5.3	FOOD LABELING

GRADE SIX

6.5.1	NUTRIENT INFORMATION
6.5.2	THE KILOCALORIE
6.5.3	WEIGHT WATCHING
6.5.4	MEAL PLANNING
6.5.5	FOOD FOR SPACE
6.5.6	FISH FOR DINNER

CLUSTER SIX - HEALTH AND SAFETY

GRADE KINDERGARTEN

K.6.1	GROWTH CHART
K.6.2	TOOTH CHART
K.6.3	TOOTH CARE
K.6.4	EXERCISE
K.6.5	GERMS
K.6.6	WASHING HANDS
K.6.7	BATHROOMS AND BASINS
K.6.8	APRONS
K.6.9	FOUNTAINS AND FAUCETS
K.6.10	GETTING SICK
K.6.11	FEELING SICK
K.6.12	GOING TO THE DOCTOR
K.6.13	WHAT DOCTORS DO
K.6.14	GOING TO THE HOSPITAL
K.6.15	RAINCOATS
K.6.16	TESTING RAINCOATS
K.6.17	WET AND COLD
K.6.18	KEEPING WARM INDOORS
K.6.19	KEEPING COOL INDOORS
K.6.20	HAND AND FOOT PROTECTION
K.6.21	GETTING LOST

GRADE ONE

1.6.1	GROWTH CHART
1.6.2	TOOTH CHART
1.6.3	BRUSHING TEETH
1.6.4	CHEWING
1.6.5	AIR AND BREATHING
1.6.6	GETTING HURT
1.6.7	STAYING HEALTHY
1.6.8	SAFETY RULES

GRADE TWO

2.6.1	GROWTH CHART
2.6.2	TOOTH CHART
2.6.3	TOOTH CARE
2.6.4	GETTING HURT
2.6.5	GETTING SICK
2.6.6	STAYING WELL
2.6.7	CLASSROOM AND PLAYGROUND SAFETY
2.6.8	FIRE SAFETY
2.6.9	USING 911

GRADE THREE

3.6.1	GROWTH CHART
3.6.2	TOOTH CHART
3.6.3	BREATHING AIR
3.6.4	ANATOMY OF BREATHING
3.6.5	LUNG MODEL
3.6.6	LUNGS AND SMOKING
3.6.7	BREATHING AND PULSE RATES
3.6.8	HEART, VEINS, AND ARTERIES
3.6.9	HEART, LUNGS, AND EXERCISE
3.6.10	DISEASE TRANSMISSION
3.6.11	TRASH AND SANITATION
3.6.12	HELPFUL DRUGS
3.6.13	PROPER DRUG USE

GRADE FOUR

4.6.1	GROWTH CHART AND AREA MEASUREMENT
4.6.2	TOOTH CHART
4.6.3	SAFETY GEAR
4.6.4	SAFETY AND PUTTING OUT FIRES
4.6.5	MAKING A FIRE
4.6.6	THINGS THAT BURN
4.6.7	SMOKING AND THE LUNGS
4.6.8	ALCOHOL, TOBACCO, AND DRUGS

GRADE FIVE

5.6.1	GROWTH CHART AND AREA MEASUREMENT
5.6.2	TOOTH CHART
5.6.3	SAFETY DEVICES
5.6.4	ALCOHOL, TOBACCO, AND DRUGS
5.6.5	SEXUALLY TRANSMITTED DISEASES
5.6.6	SEXUALLY TRANSMITTED DISEASE QUIZ
5.6.7	TOBACCO QUIZ
5.6.8	SMOKERS' SURVEY
5.6.9	EX-SMOKERS' SURVEY
5.6.10	SMOKING LAWS
5.6.11	ALCOHOL QUIZ
5.6.12	ALCOHOL LAWS
5.6.13	CHRIS'S STORY
5.6.14	THE PARENTS' STORY
5.6.15	INTOXICATION
5.6.16	DRUG LAWS

GRADE SIX

6.6.1	GROWTH CHART
6.6.2	TOOTH CHART
6.6.3	SAFETY DEVICES
6.6.4	DISEASE LITERATURE
6.6.5	SANITATION
6.6.6	DISEASE-PRODUCING ORGANISMS
6.6.7	SEXUALLY TRANSMITTED DISEASES
6.6.8	DRUG ABUSE: PREVENTION AND TREATMENT
6.6.9	ALCOHOL AND TOBACCO
6.6.10	ENVIRONMENTAL DISEASE : TRANSMISSION, PREVENTION, AND TREATMENT
6.6.11	EXERCISE AND HEALTH AND THE MARS MISSION

CLUSTER SEVEN - WAYFINDING AND TRANSPORTATION

GRADE KINDERGARTEN

K.7.1 RIGHT AND LEFT
K.7.2 SUNRISE
K.7.3 SUNSET
K.7.4 NORTH AND SOUTH
K.7.5 HOME LOCATION
K.7.6 SIDEWALKS AND WALKWAYS
K.7.7 ROADS
K.7.8 TRAFFIC SIMULATION EQUIPMENT
K.7.9 TRAFFIC SIMULATION MAPPING
K.7.10 TRAFFIC SIMULATION RULES
K.7.11 CLASSROOM MAPPING

GRADE ONE

1.7.1 PACING
1.7.2 NORTH, SOUTH, EAST, AND WEST
1.7.3 HOME
1.7.4 MAP DISTANCE
1.7.5 MAKING A BOAT
1.7.6 MAKING A LAKE
1.7.7 THE GREAT REGATTA
1.7.8 FLOATING AND SINKING
1.7.9 DRAINING A LAKE

GRADE TWO

2.7.1 TRANSPORTATION SYSTEMS
2.7.2 MAKING RACE CARS
2.7.3 RACING AND MODIFYING CARS
2.7.4 ROADS
2.7.5 BUILDING A VILLAGE
2.7.6 PEDESTRIANS IN THE VILLAGE
2.7.7 BIKES IN THE VILLAGE
2.7.8 CARS IN THE VILLAGE
2.7.9 BIKES AND TRIKES
2.7.10 BELTS AND PULLEYS
2.7.11 FAST AND SLOW PULLEYS
2.7.12 GEARS AND WHEELS

GRADE THREE

3.7.1 GARDEN MOVER
3.7.2 PROPELLER-DRIVEN MESSAGE CENTER
3.7.3 PROPELLER-DRIVEN BOAT
3.7.4 DELIVERY SYSTEMS

GRADE FOUR

4.7.1 BOAT DESIGN
4.7.2 WIND AND SAILS

GRADE FIVE

5.7.1 WHERE IN THE WORLD ARE WE?
5.7.2 PLANETARIUM
5.7.3 MAPPING THE SKY
5.7.4 THE NORTH POLE, EQUATOR, AND ECLIPTIC
5.7.5 WHERE IS EARTH?

GRADE SIX

6.7.1 FLYING AIRPLANES
6.7.2 FLYING ROCKETS
6.7.3 SPACECRAFT
6.7.4 THE ORBIT OF MARS
6.7.5 WHAT PATH TO MARS?

CLUSTER EIGHT - ENERGY AND COMMUNICATION

GRADE KINDERGARTEN

K.8.1	ENERGY
K.8.2	MAKING THINGS MOVE
K.8.3	MAKING THINGS STOP
K.8.4	TURNING THINGS OFF
K.8.5	TURNING THINGS ON
K.8.6	REPAIRING THINGS

GRADE ONE

1.8.1	TEMPERATURE OF THINGS
1.8.2	THE MASTER THERMOMETER
1.8.3	HOT AND COLD
1.8.4	SOURCES OF ENERGY

GRADE TWO

2.8.1	CAMERA OBSCURA
2.8.2	MIRRORS AND SUNLIGHT
2.8.3	CLOUDS AND SUNLIGHT
2.8.4	COMPARING TEMPERATURES
2.8.5	ECLIPSES

GRADE THREE

3.8.1	SHADOW, LIGHT, AND BUBBLES
3.8.2	WIND AND HEAT
3.8.3	WIND PULLS AND PUSHES
3.8.4	PROPELLERS DRIVING PROPELLERS
3.8.5	WATERWHEELS
3.8.6	PROPELLERS IN WATER
3.8.7	HELIOGRAPH
3.8.8	SPEAKING TUBE
3.8.9	STRING TELEPHONE
3.8.10	ENERGY DEFINITIONS

GRADE FOUR

4.8.1	PUSH-PULL MEASURING TOOL
4.8.2	FRICTION
4.8.3	STREAMLINING
4.8.4	PRESSURE, SHARP EDGES, AND POINTS
4.8.5	ENERGY OF FALLING OBJECTS
4.8.6	CIRCLES AND SPEED

GRADE FIVE

5.8.1	PUSHES, PULLS, AND FORCES
5.8.2	TEETER-TOTTERS
5.8.3	THE BALANCE
5.8.4	WHEELS AND AXLES
5.8.5	LEVERS: WHERE ARE THEY?
5.8.6	ARMS AND JAWS
5.8.7	INCLINED PLANES AND SCREWS
5.8.8	BLOCK AND TACKLE
5.8.9	FORCES PROJECTS

GRADE SIX

6.8.1	ROCKET PROPULSION
6.8.2	MAGNETISM
6.8.3	ELECTROSTATICS
6.8.4	ELECTRICAL CIRCUITS
6.8.5	ROCK FORMATION
6.8.6	METALS FROM ROCK
6.8.7	ASYMMETRICAL LEVER

CLUSTER NINE - CONSERVATION, RECYCLING AND DECOMPOSITION

GRADE KINDERGARTEN

K.9.1 DECOMPOSITION
K.9.2 WASTE DISPOSAL
K.9.3 RECYCLING PROJECT
K.9.4 MAKING PAPER

GRADE ONE

1.9.1 CONSERVING CLASSROOM RESOURCES
1.9.2 CONSERVING ENERGY
1.9.3 CONSERVING WATER
1.9.4 DECOMPOSITION AND UNEARTHING
1.9.5 DECOMPOSITION AND REBURIAL
1.9.6 RECYCLING

GRADE TWO

2.9.1 FALL UNEARTHING
2.9.2 FALL BURYING
2.9.3 SPRING UNEARTHING
2.9.4 SPRING BURYING
2.9.5 POLLUTION SURVEY AND CLEANUP
2.9.6 ALUMINUM RECYCLING
2.9.7 CONNECTIONS

GRADE THREE

3.9.1 MAKING COMPOST
3.9.2 WATCHING COMPOST
3.9.3 ANIMALS IN COMPOST
3.9.4 USING COMPOST
3.9.5 FALL UNEARTHING AND BURIAL
3.9.6 SPRING UNEARTHING AND BURIAL

GRADE FOUR

4.9.1 UNEARTHING AND BURIAL
4.9.2 RECYCLING PROJECT

GRADE FIVE

5.9.1 CLASS RECYCLING PROJECT
5.9.2 CLASS CONSERVATION PROJECT
5.9.3 DECOMPOSITION AND ARCHEOLOGY
5.9.4 POLLUTION PROJECT

GRADE SIX

6.9.1 CLASS RECYCLING PROJECT
6.9.2 CONSERVATION
6.9.3 DECOMPOSITION: A SUMMARY
6.9.4 POLLUTION

CLUSTER TEN - MATTER SPACE, AND CONSTRUCTION

GRADE KINDERGARTEN

K.10.1	CUBBY ORGANIZATION
K.10.2	PATTERNS IN PUZZLES
K.10.3	MAKING PUZZLES
K.10.4	MAKING ENVELOPES
K.10.5	MAKING BOXES AND BAGS
K.10.6	VOLUME OF BOXES AND BAGS
K.10.7	PACKING AND STORING
K.10.8	LINEAR MEASUREMENT

GRADE ONE

1.10.1	METER-STRING CAN
1.10.2	OUTDOOR STUDY AREA MAPPING
1.10.3	TESTING FOR WATER
1.10.4	PLUMBING
1.10.5	WATER SYSTEMS
1.10.6	AIR
1.10.7	BUBBLES IN WATER
1.10.8	BUBBLES IN AIR
1.10.9	BUILDING WITH AIR
1.10.10	FLOOR PLAN
1.10.11	FLOOR PLAN MODEL
1.10.12	CARDBOARD HOUSE PLAN
1.10.13	MAKING A CARDBOARD HOUSE
1.10.14	PAINTING THE HOUSE
1.10.15	FURNISHING THE HOUSE
1.10.16	SEWING
1.10.17	WEAVING
1.10.18	WARMING AND COOLING THE HOUSE
1.10.19	LIGHTING THE HOUSE
1.10.20	SAFETY EQUIPMENT

GRADE TWO

2.10.1	DESK ORGANIZATION
2.10.2	NOTEBOOK ORGANIZATION
2.10.3	THE BALANCE
2.10.4	METER-STRING CAN
2.10.5	MEASURING VOLUME
2.10.6	SAFETY EQUIPMENT

GRADE THREE

3.10.1	ACIDIC AND BASIC SOIL
3.10.2	ACIDS AND BASES
3.10.3	ACID AND BASE REACTIONS
3.10.4	DILUTING ACIDS AND BASES
3.10.5	ACID AND BASE INTERACTION
3.10.6	DISSOLVING THINGS
3.10.7	THINGS IN LIQUIDS
3.10.8	CRYSTALS
3.10.9	RAIN IN A JAR
3.10.10	SUPERMARKET PLANNING
3.10.11	SUPERMARKET CONSTRUCTION
3.10.12	MEASURING DEVICES
3.10.13	SAFETY EQUIPMENT

GRADE FOUR

4.10.1	LINEAR MEASUREMENT
4.10.2	VOLUME MEASUREMENT
4.10.3	MASS MEASUREMENT
4.10.4	COLLECTING ROCKS
4.10.5	HARDNESS OF ROCKS
4.10.6	SPECIFIC GRAVITY
4.10.7	ROCKS AND SHARP EDGES
4.10.8	MAKING TOOLS FROM ROCK
4.10.9	MAKING FISHING TOOLS
4.10.10	CLOWNS:THINGS THAT FLOAT
4.10.11	CLAY
4.10.12	FIRE AND POTTERY
4.10.13	AIR AND FIRE
4.10.14	FIRE AND OXYGEN
4.10.15	PROPERTIES OF GASES

GRADE FIVE

5.10.1	LINEAR MEASUREMENT
5.10.2	VOLUME MEASUREMENT
5.10.3	CAMERA OBSCURA
5.10.4	CONTROLLING LIGHT WITH LENSES
5.10.5	MAKING A TELESCOPE
5.10.6	STABILIZING THE TELESCOPE
5.10.7	MAKING A MICROSCOPE
5.10.8	MAKING A HYGROMETER
5.10.9	MAKING A BAROMETER

GRADE SIX

6.10.1	MAKING MEASURING EQUIPMENT
6.10.2	MAKING BALANCES
6.10.3	MAKING AN ELECTROSCOPE
6.10.4	MAKING ELECTROMAGNETS AND CURRENT INDICATORS
6.10.5	MAKING ELECTRIC CELLS
6.10.6	MAKING AN ELECTRIC MOTOR
6.10.7	MAKING AN ELECTRIC SIGNALER
6.10.8	MAKING A SURVIVAL HABITAT

DASH

GRADE 2

MATERIALS LIST

DASH Grade 2 Equipment and Supplies

Classroom Supplies

Consumable
- Brass fasteners, 30, 1/2"
- Bulldog clamps, 2", 2-3/group
- Chalk, sidewalk, asstd. colors, sev. pkgs.
- Chart paper, plain and 1" grid
- Construction paper, asstd.
- Crayons
- Glue, white and Post-it
- Index cards, 5" X 8" & 3" X 5", asstd.
- Markers, asstd. colors, washable
- Markers, waterproof, asstd.
- Oak tag, chart size, other asstd.
- Pencils
- Paperclips, large, 1 box
- Pushpins
- Rubberbands, thick and thin, asstd.
- Rulers, in. & cm
- Staples
- String, asstd.
- String, heavy cord preferred (11-20m / group)
- Tapes, masking, cellophane

Permanent
- Clock, classroom (analog)
- Meterstick or tape, 2-8, (1 required)
- Paper punch, single hole
- Scissors, heavy duty (universal or bandage)
- Scissors, student
- Staplers

Consumable Supplies (Discount Department Store or Grocery Store)

- Balloons, 1 pkg. asstd.
- Beads, plastic crow, 1 pkg.
- Candles, votive, 1/group
- Cheese cloth, 1 pkg.
- Chopsticks , 1 pkg.
- Clothespins, wood
- Craft sticks, wood, 1 pkg.
- Cups, styrofoam, 25-50
- Dowel or stick, 1/4" diam., 24" long
- Facial tissues, 1 box
- Foil, aluminum, 1 roll
- Food coloring
- Forks and spoons, plastic (25-30 each)
- Gloves, plastic
- Matches, safety
- Paper plates, 6-8" diam, 2/student
- Paper towels, 2-4 rolls
- Pet supplies (fish)
- Pie or cake pans, aluminum, 4/group
- Plastic bags, sandwich size, resealable, 100
- Plastic bags, resealable, asstd. sizes
- Plastic bags, large, 2-3/student, (colors opt.)
- Plastic cups, clear, soft, 9-10 oz., 50-75
- Plastic wrap, 1 roll.
- Skewers, wood, 1 pkg.
- Straws, plastic, 1 box
- Tape, duct, 4-6 rolls
- Tapes, asstd. colored plastic (opt.)
- Thread, sewing needles, asstd. (opt.)
- Toothpicks, 1 box

Permanent Supplies*

- Aquarium and supplies (pump, filter, etc.)
- Bicycle and tricycle
- Camera (opt.)
- Cooking & food preparation equipment, asstd.
- Clock, digital (opt.)
- Centigram cubes or other metric mass wts. & other small objects for weighing with
- Dishpans, buckets or large bowls, 4-6
- Garden hose
- Goggles, 1-2
- Hand lenses, 1/2 students
- Hand tools for student use, asstd.
- Hot water source
- Ice source
- Magnetic compass
- Magnets (opt.)
- Map, local area
- Mirrors, small, 8-12
- Overhead projector
- Puppets, animal or others (opt.)
- Rock crusher: 12-18" threaded metal pipe, 1.5" diam., w/ metal cap to fit one end 2-2.5' threaded metal pipe, 3/4" diam. w/ metal cap to fit one end
- Scale, bathroom
- Stopwatch (opt.)
- Thermometers, small, 8-12, w/ °C & °F
- Tongs, 1 if demo or 6-8 (1/group)

***Many of these items can be borrowed or shared within a school.**

Recycled Materials

- Aluminum pie pans and asstd. containers
- Bags, paper, plastic, asstd. sizes
- Boxes, corrugated cardboard, asstd.
- Cans, metal. gal. (w/lids) & other asstd.
- Cans, other containers, straight-sided
- Cardboard milk or juice cartons, asstd. sizes
- Corks
- Fabric scraps
- Film canisters
- Hangers, thin metal
- Jars, gal.,qt. and other asstd.
- Lids, metal and plastic, asstd.
- Magazines with colored pictures
- Nails, asstd.
- Nail, iron or fat needles
- Nails, iron, asstd.
- Nails, 3 different diameters, 1 ea./group
- Newspapers
- Nylon stockings
- Plastic containers, soda bottles, other asstd., some matched pairs
- Potting soil, 1 large bag
- Sandpaper, asstd.
- Screening, fiberglass
- Seeds, radish, alfalfa, asstd. flower & vegetable for growing in pots
- Socks
- Styrofoam, asstd. pieces and containers
- Tubes, cardboard, asstd.
- Upholstery tacks, flat heads, 2-3 pkgs.
- Wood scraps, asstd.wood dowel pieces (1/4")
- Yarn, asst. craft supplies

Special Purchase

- Almanac, current year or internet/ daily newspaper/phone access
- Calendar paper-24" roll or computer
- Calendar, 1 year on a page (opt.)
- Pets, aquarium fish and plants, snail
- Teeth model (optional)
- Thermometer,large, w/ °C & °F
- Tubing, clear plastic, asstd. sizes and lengths

Other

- Bleach (small amt.)
- Foods (usually requested from students)
- Plant bulbs and tubers (1-2 each)
- Plant cuttings
- Tee-shirts, black or dark colored, 1/group
- Toothbrushes, students personal
- Toothpaste
- Vinegar (small amt.) or rennet/junket

DASH

GRADE 2

COMPLEMENTARY MATERIALS

DASH

DEVELOPMENTAL APPROACHES IN SCIENCE AND HEALTH

ON HOME

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ACTIVITIES FOR FAMILIES

VOLUME 2, NUMBER 1

Fire prevention is an important topic in October because National Fire Prevention Week is the week of October 9th, the day of the great Chicago fire in 1871. Fall is a good time to take up fire and general safety concerns in your home.

FAMILY FIRE DRILLS

Involve your child in planning for home fire safety. Discuss ways of getting out of the house quickly. Talk about the different ways of leaving each room. Discuss the importance of knowing alternate ways of leaving. Decide on a place to meet outside the house. After you have made your plan, have a family fire drill. Review your plan periodically to be certain everyone knows what to do and where to go.

Talk about the reasons for fire safety rules: Why we walk and don't run. Why we leave our belongings behind. Why we crawl if there is smoke in a room. Why we test to determine whether a door is hot before we open it. Why we roll on the floor or ground if our clothes catch fire. Why we meet at a certain place once we are out of the house. **(Health and Safety)**

DASH

This newsletter has been designed for the *Developmental Approaches in Science and Health* (DASH) curriculum that is being used in your child's school. DASH is a new curriculum for kindergarten through sixth grade. DASH connects science, health and technology subjects into all aspects of the school program.

You can bring "DASH on home" by helping your child with these activities. This newsletter will give you some ideas. Save the newsletters and take your time with them.

DASH has several units, called "clusters." The activities in this newsletter complement several DASH clusters. Look for **bold letters** to indicate the DASH ideas.

If you have any questions or comments about *DASH on Home*, please contact: DASH c/o The Children's School, Carnegie Mellon University, MMCC 17, Pittsburgh, PA 15213.

FIRE PREVENTION RAP

If you want to be good firefighters,
Steer clear of matches and cigarette lighters.
Another safety thing to learn:
Things on the stove can cause a burn.
Keep greasy rags away from flame,
'Cause fire safety is no game.

PILOT LIGHT SEARCH

Not all flames are to be feared. Pilot lights can be found in gas stoves, water heaters and furnaces. They should burn blue and clear.

To find them almost always means removing a protective cover. Why?

Suggestion: Discussing and practicing fire safety can make the difference in your child's chances of surviving a fire. Taking a matter-of-fact attitude can reduce fear. But too much talk about fires can lead to excessive worrying and even nightmares. Emphasize that knowing and practicing what to do makes us all safer.

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VOLUME 2, NUMBER 1

TELEPHONE SKILLS AND SAFETY

Knowing how to use the telephone is an important safety skill. Have your child practice:

- Calling a grandparent, relative, or friend
- Calling to get the time and weather
- Calling to find out the movie schedule
- Calling to order a pizza

Have your child practice your telephone number, including the area code. Make calls together using a pay phone. Assist your child in making a practice collect call to a relative. Talk about how this might be necessary in an emergency.

Go over the names of people to call in an emergency. Include 911 emergency service (or fire and police), home and work numbers, the operator, a neighbor, a friend or a relative.

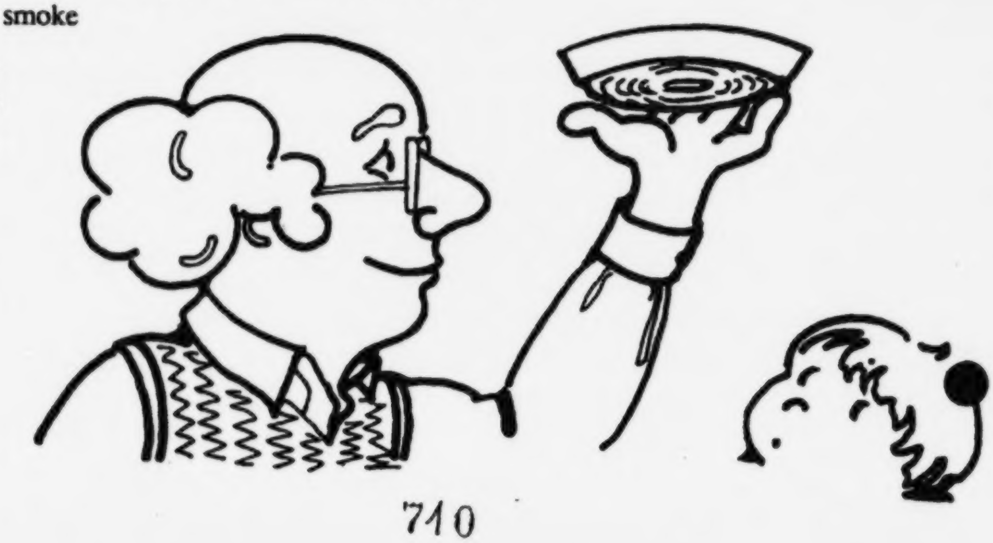
Play an Emergency Phone Call Game. Tell a story in which someone needs help and ask what number you would call. Help your child make a list of emergency and frequently called numbers and post it next to the phone. (**Health and Safety, Energy and Communication**)

SMOKE DETECTORS

Involve your child in learning about smoke detectors. If you need to put up a new smoke detector, read over the instructions with your child and decide together where to put it. If you already have smoke detectors, help your child figure out why they have been placed in particular locations. Ask why there should be one near the kitchen and another near the bedrooms? Discuss why they should be put up high.

Have your child help with smoke detector maintenance, such as testing to see that a detector is working correctly and replacing the battery annually.

Work out family rules for what to do when a detector goes off. Add this to your fire safety rules. (**Health and Safety**)



DASH

DEVELOPMENTAL APPROACHES IN SCIENCE AND HEALTH

ON HOME

1993

ACTIVITIES FOR FAMILIES

VOLUME 2, NUMBER 2

SCIENTISTS SPEND MUCH OF THEIR TIME RECORDING WHAT THEY OBSERVE AND THINKING ABOUT WHAT THEY HAVE RECORDED. THEY LOOK FOR PATTERNS AND TRY TO MAKE PREDICTIONS ABOUT THINGS THAT WILL HAPPEN IN THE FUTURE.

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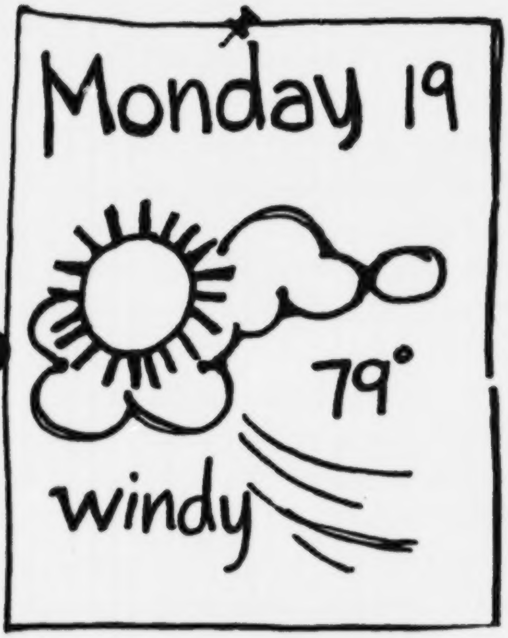


WEATHER RECORDS

Watch or listen to weather reports with your child and then talk about what the reports mean: Is it going to be hot, cool, cold? Is it likely to rain? Is it supposed to be sunny? Keep a record to see how often the weather report is accurate in predicting the weather. Start making family predictions of what the weather will be. Keep a record of your predictions. How often were you correct? Set up a temperature observation "station" outside of the house. Predict and record the morning and evening temperatures. **(Weather)**

RECYCLING RECORD

See whether your child knows what materials are recycled in your community. Have your child help with gathering and packaging material for recycling. Keep a record of how much material you recycle. Compare this amount with the amount of material that comes into your home. Invent a way to measure materials. ("Bags in" and "bags out" might work.)

Find out how materials are recycled. How are materials processed for reuse? What happens to other trash and garbage? Is any of it burned to produce electricity? Or decomposed to make compost? **(Conservation, Recycling and Decomposition)**

Suggestion: Whenever you can, reinforce concepts taught at school by making connections with things outside school. This validates the usefulness and importance of school learning.

VOLUME 2. NUMBER 2

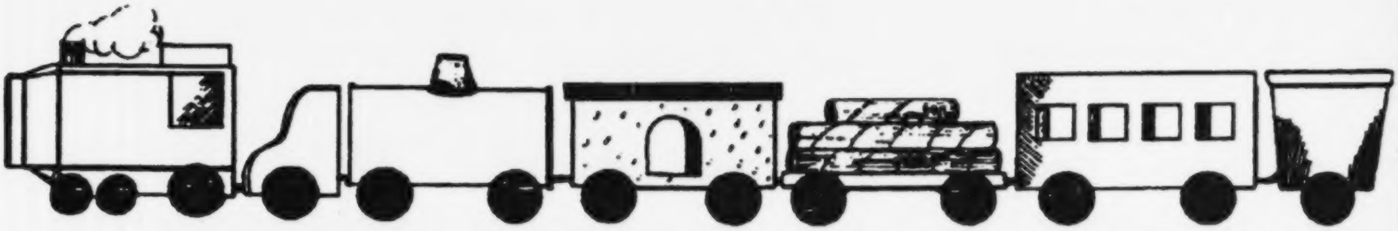
DECOMPOSITION PREDICTIONS

At school your child has been involved in a project to see how fast (or slowly) garbage and trash decompose. You may want to try this same activity at home. Collect small pieces of your trash and garbage. Make a record of what you predict will happen if they stay in the ground for several months. Which items will decompose? Which will not? Bury your items in a net bag (the kind oranges come in). When you dig up the garbage, you can check to see which of your predictions were correct and record your results.

If you do not have anywhere to bury the garbage, you can use a large can with dirt packed around the items. Punch holes in the bottom of the can and place it on a shallow pan of water to keep the dirt moist. If it starts to smell, cover the can with a lid or with aluminum foil. **(Conservation, Recycling and Decomposition)**

BUILDING A SALVAGE TRAIN

Another type of recycling is called salvage. Salvaged things are reused, often in a different way from the way they were originally used. Help your child collect different kinds of containers and build a "salvage train." Small cereal boxes, round oatmeal and salt boxes, plastic bottles, milk cartons, and egg cartons can be used for the train cars. Plastic or metal lids, paper towel and toilet paper tubes make great wheels. Invent ways to connect pieces and attach wheels—you could use wooden barbecue skewers, paper clips and tape, for example.



Invent other ways to salvage and reuse items that you would otherwise throw away. **(Conservation, Recycling and Decomposition)**